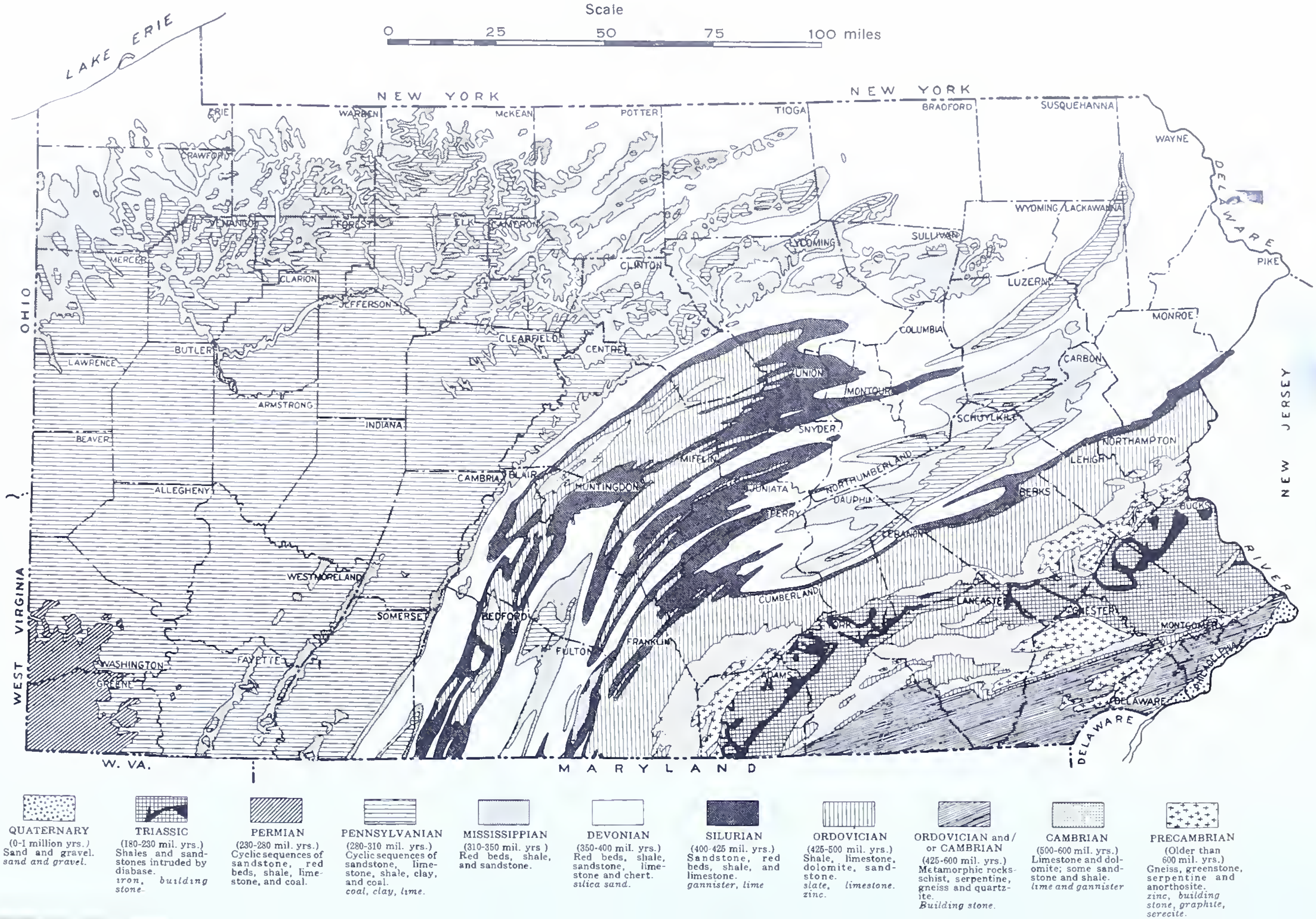
MINERAL COLLECTING IN PENNSYLVANIA

GEOLOGIC MAP OF PENNSYLVANIA



GENERAL GEOLOGY REPORT 33 1976

MINERAL COLLECTING IN PENNSYLVANIA

by

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COMMONWEALTH OF PENNSYLVANIA
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Arthur A. Socolow, *State Geologist*

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Front cover: **Mass of tetrahedral chalcopyrite crystals etched from calcite, French Creek mines. (courtesy of John S. White)**

Back cover: *Upper left:* **galena with cubic and octahedral cleavages, Pequea silver mine;** *middle left:* **azurite crystals on calcite, "old" Lime Bluff quarry, Muncy;** *right*: **fibrous tremolite, C. K. Williams quarry, Easton:** *bottom*: **calcite crystals with oriented coatings of goethite, "old" Lime Bluff quarry, Muncy. (courtesy of Delbert L. Oswald)**

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DEDICATION

DAVIS M. LAPHAM
(1931-1974)

An outstanding mineralogist and a wonderful friend

This edition of Mineral Collecting in Pennsylvania is dedicated to the late Dr. Davis M. Lapham of our staff. Dr. Lapham was the original senior author of this report in 1959 and of succeeding revisions and maintained an active file of new localities, minerals, and corrections which greatly improved this edition. We deeply and sincerely regret that Dave is not with us to continue this authorship.

Cedar Hill quarry where Dave had done much of his work

PREFACE

"Mineral collecting just isn't what it used to be! Old collecting spots are closed or have been built over and there are only a few localities left anymore." This commonly heard statement simply is not true. Interest in minerals is growing rapidly, yes; more people are collecting than ever before, yes; but new minerals for the state and new localities are springing up almost as fast as the old ones are being lost. Take a look at the mineral species list on page 20; how many do you recognize as being new? This is an exciting time for mineral collectors, and just a little extra effort can bring great rewards. Today many collectors are better acquainted with the concepts of geological and mineralogical associations and are using this information to find some rare and spectacular treasures of nature.

This book was written with both the novice and the more advanced collector in mind. Localities were selected on the basis of abundance and variety of minerals that can be found there today. In addition, emphasis was placed on including as many different types of occurrences as possible so as to give the collector both geographic and geologic diversity. Brief geological summaries are given for each locality which provide useful information concerning the variety of rock types present, the origin of the various minerals and even some clues as to possible additional minerals which may be present but have not been recognized from that specific locality.

If you are just getting started in this fascinating world of minerals, talk to mineral club members, museum curators, local geologists and mineralogists and get their help. For you advanced collectors, take time to study your collection and those of others; look at the minerals and the rocks in which they occur, and attempt to determine what factors are important in finding better specimens of the same mineral and other associated minerals. The minerals are there; it is just a matter of looking for their clues.

Please note that the listing of a locality does not constitute permission to enter a property or to collect minerals. Always ask permission from the owners of the land, from the quarry or mine operators before entering to collect. (Land ownership listed as of August, 1975) *Never trespass.* If it appears impossible to locate the owner of a particular site, remember it is possible to visit the county courthouse in which the site is located, and trace the ownership through deeds records or tax maps. In the past, abuses of inconsiderate collectors have caused manny excellent localities to be closed.

As you pursue this fascinating hobby, we urge you to take every safety precaution in the quarries, pits and road cuts; always ask permission to collect; and above all, enjoy the experience.

ACKNOWLEDGEMENTS

We gratefully acknowledge the first author of earlier editions of G 33, Davis M. Lapham, for establishing the format of the guide and for maintaining an updated manuscript which served as a base for the present edition. It was under Dr. Lapham's guidance that many of the interesting and unusual minerals listed here were properly identified.

To the members of Friends of Mineralogy, Region III, we are indebted for most of the new localities listed in this edition (Martin L. Anné, Donald T. Hoff, Karl Jones, Delbert L. Oswald, James Quickel and Donald Schmerling); the back cover photographs (D. Oswald), most of the black and white mineral photographs (Col. Thomas W. Myers, U.S.A. ret.); the museum listing (D. Oswald); the club listing (J. Penrose Ambler and Betty Clauser); and review (Juliet Reed and M. Anné). Many of the same individuals have provided up-to-date corrections of the changing entrance requirements.

More data than can be properly referenced in a guide of this type has been taken from Arthur Montgomery's columns on *Pennsylvania Minerals* in the "Keystone Newsletter", published by the Mineralogical Society of Pennsylvania.

Many of the field photographs were taken by William H. Bolles. Harold Evans has kindly permitted us to use his historical photos of French Creek. John S. White, Jr. of the Smithsonian Institution provided the front cover photograph. We also acknowledge the assistance of our colleagues at the Pennsylvania Geological Survey who helped in various aspects of this compilation.

Finally, we acknowledge the many quarry and property owners who have aided the authors.

Mineralization at Gap was discovered prior to 1722. The water was tested for copper by Benjamin Franklin. In 1732 Gap mine land was owned by the honorable Proprietors Thomas Penn, Andrew Hamilton, James Logan, William Allen, Thomas Schute, and James Steele.

CONTENTS

INTRODUCTION

Gemstones, rocks and minerals have played a significant role in man's history as far back as the times that he selectively looked for the naturally occurring materials such as chert and flint and used them for tools and hunting instruments. Many early civilizations were familiar with metal ores and made wide use of copper, iron and bronze as weapons, tools, ornaments and coinage. Today, nearly everything that we use other than food, clothing and agricultural products has been mined from the earth. Each step of our modern technology is aided by the knowledge and development of our mineral resources.

The science of mineralogy and the study of minerals is just one of a number of divisions of the earth sciences. As a branch of geology, it is closely related to chemistry and physics, all of which are involved in the understanding of the natural processes behind the formation of minerals, ores, mineral fuels, rocks and fossils. In this work, the science of mineralogy makes constant and vital contributions.

The earth's crust contains approximately 2300 known species of minerals, many of which are rarely seen. But a great number of minerals are easily found and one does not necessarily have to travel great distances to collect them; often a mineral may literally occur in your own back yard.

Thanks to nature's generosity, Pennsylvania contains a large number of igneous, metamorphic and sedimentary rock types. As a result, a great variety of minerals can be found in each rock type, both as primary minerals, forming at the same time or soon after the rocks formed, and as secondary minerals which resulted from the weathering of the rocks. To date, nearly 300 mineral species have been found in the Commonwealth and there are probably more to be found. Many of the localities in this publication should provide good, abundant material for both the beginner and the advanced collector. Use this book both as a field guide to locate collecting sites and later as a reference for more detailed and advanced work. Above all, enjoy the riches that this land has to offer.

SAFETY

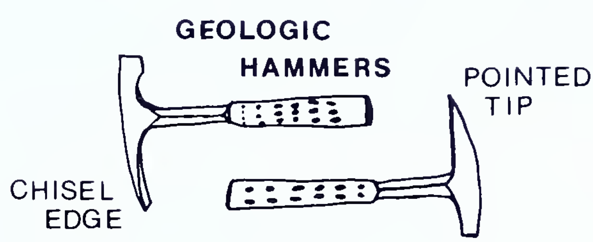
While mineral collecting, it is important to take a few but necessary safety precautions. Being in quarries, stopping alongside road cuts, or digging around old mine shafts and workings presents some potentially hazardous situations, but with a little care and attention to possible dangers, accidents and injuries can be avoided.

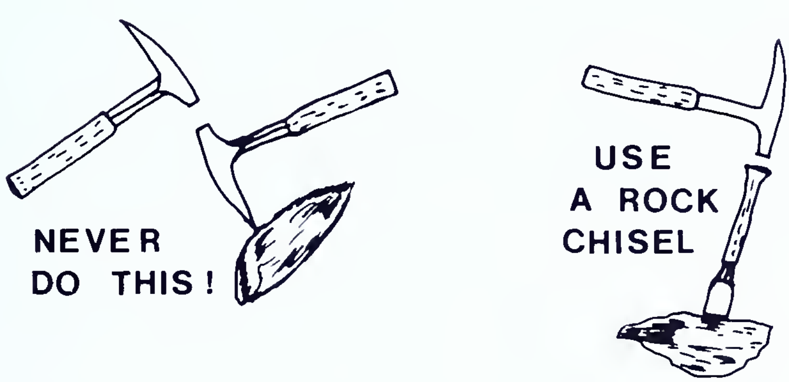
Hard hats are mandatory in all operating quarries and pits and are highly recommended for anyone working near a high-walled rock outcropping such as a steep road cut. Even the smallest rock falling from a height can be extremely hazardous. Hard-toed shoes are a wise precaution in any collecting situation and these too are required for entry into quarries and pits. Use safety goggles or safety glasses while hammering or chiseling; small chips of rock or metal commonly break off and fly out at great speeds. This fact cannot be overemphasized; safeguard your eyes. And heavy work gloves, while at times are awkward to use, may prevent a cut or protect your hand from a severe hammer blow.

It is best to use a geologic pick or hammer for breaking rock. Common household tools such as hammers or screw drivers are not made for working on rock and can cause injury if the metal breaks or splinters. The pointed tip or chisel edge, depending on the style geologic hammer you have, is primarily designed for prying and digging and not for hammering. Never use these tips in place of a rock chisel and hammer one upon the other! Hammer heads are made of hard brittle steel which splinters off easily while rock chisels are of softer metal which does not splinter.

Look around before you collect in an area. Note all high rock faces and steep cliffs and do not collect under them. See where other people are and keep a safe distance away from them. Never work above or below a person on a rock slope; you may cause a rock slide endangering you and the other person. Be aware that explosive devices, such as blasting caps, could be found in any quarry; do not disturb them and report their location to someone in charge. Ask yourself if the area could contain snakes; if so, be on the lookout for them and take proper precautions. Does the collecting site have poison ivy, poison oak or other troublesome plants?

The time it takes to become aware of the problems of a collecting site is well spent if it can prevent an accident. Above all, use common sense: think safety, act safely, be safe.





CODE OF ETHICS

The American Federation of Mineralogical Societies has produced a highly recommended "code of ethics" for the mineral collector. It reads as follows:

I will respect both public and private property and will do no collecting on privately owned land without the owner's permission.

I will keep informed of all laws, regulations or rules governing collecting on public lands and will observe them.

I will, to the best of my ability, ascertain the boundary lines of property on which I plan to collect.

I will use no firearms or blasting material in collecting areas. I will cause no wilful damage to property of any kind — fences, signs, buildings, etc.

I will leave all gates as found.

I will build fires in designated or safe places only and will be certain they are completely extinguished before leaving the area.

I will discard no burning material — matches, cigarettes, etc.

I will fill all excavation holes which may be dangerous to livestock.

I will not contaminate wells, creeks, or other water supply.

I will cause no wilful damage to collecting material and will take home only what I can reasonably use.

I will support the rockhound project H.E.L.P. (Help Eliminate Litter, Please) and will leave all collecting areas devoid of litter, regardless of how found.

I will cooperate with field trip leaders and those in designated authority in all collecting areas.

I will report to my club or federation officers, Bureau of Land Management, or other proper authorities, any deposit of petrified wood or other material on public lands which should be protected for the enjoyment of future generations for public education and scientific purposes.

I will appreciate and protect our heritage of natural resources.

I will observe the "Golden Rule", will use "Good Outdoor Manners" and will at all times conduct myself in a manner which will add to the stature and "Public Image" of rockhounds everywhere.

In this era of environmental awareness, the mineral collector should be particularly conscious of those unique natural sites that should be designated or preserved for future generations. Comments and suggestions may always be forwarded to the Survey.

MAPS

The first step in mineral collecting is knowing how to get to the actual collecting site. Maps are given for every locality listed in this book; however, it is often desirable to have additional information, such as the type of roads, trails or terrain one will encounter at the site and the geology of the general region.

ROAD MAPS

The first map that should always be checked is a good road map. It will indicate the numbered state, U.S. and Interstate highways as well as many of the secondary roads. In addition, determine the location of the nearest towns, county boundaries, township boundaries if marked, state lines and rivers and streams. The road map plus the detailed locality map given in this book should provide enough information to find each collecting locality.

TOPOGRAPHIC MAPS

The topographic maps referred to constantly throughout this book provide extremely detailed information about an area and are relatively inexpensive (about $1.00 per map) and easy to obtain. A topographic map tries to show on paper what you would see flying over the area in a plane and looking down at the ground. Natural land features, such as hills, valleys, streams and man-made roads, trails, buildings, dams, quarries, and mines are shown. In addition, township, county and state boundaries, road names, highway route numbers, elevations above sea level and latitude and longitude are marked on these maps. The maps are printed in color with physiographic features indicated in brown, streams and bodies of water in blue, vegetation in green, roads in black and red, and other man-made features in black. Many maps are available in photorevised versions, meaning that they have been updated using data obtained from aerial photography. Such revisions are indicated in purple.

On topographic maps, brown contour lines are used to show natural land features. These lines are imaginary (they don't exist on the ground) and connect points of equal elevation above sea level. Thus, every point along the 360 foot contour line, for example, is 360 feet above sea level. Usually every fifth contour line is darkened to make the map easier to read. The difference in elevation between two adjacent contour lines is referred to as the contour interval and is printed at the bottom of the map. Widely spaced contour lines indicate relatively flat land while closely spaced contour lines indicate a steep grade or slope.

Distances between points can be measured directly using the bar scale at the bottom of the map. In addition, a ratio scale is given, such as 1:24,000 meaning that one unit (inch, centimeter, etc.) on the map represents 24,000 of the same unit (inch, centimeter, etc.) on the ground.

The topographic maps that cover an area representing 7 ½ minutes of latitude and 7 ½ minutes of longitude are called 7 ½-minute quadrangles. These maps are printed at a scale of 1:24,000 (2 ½ inches on the map is approximately 1 mile on the ground) and cover an area of approximately 48 square miles. The location maps used throughout this book are taken from 7 ½-minute quadrangles. Another series of topographic maps is the 15-minute series of quadrangles. printed at a scale of 1:62,500 and covering 4 times the area of a 7 ½-minute quadrangle. The 15-minute quadrangles are no longer being printed, although some are still in existance. Because many 7 ½-minute quadrangles bear the same name as 15-minute quadrangles, caution should be exercised in using older maps and old references to maps. All references to specific quadrangles in this book are to 7 ½-minute quadrangles.

The U.S. Geological Survey prepares and distributes topographic maps, index maps that show the location, scale and edition date of published maps, and a sheet listing all the symbols used on the quadrangles (see page 8). These are available from the Map Distribution Center, U.S. Geological Survey, 1200 South Eads Street, Arlington, Va. 22202. Some topographic maps can also be purchased from local dealers (see list on page 240).

GEOLOGIC MAPS

A geologic map is a specialized map that shows the rock types, and the relative ages and distribution of each rock type in the map area. It indicates this through the use of colors (or patterns) and symbols that are keyed to a legend in which each type of bedrock represented on the map is briefly described. A simplified geologic map of Pennsylvania is on the inside front cover.

Studying a geologic map reveals more than the age and type of rock at a locality. It also shows the structure of the bedrock. Areas with nearly flat layers of rock usually have only a small number of units exposed over a large area. Regions with gently dipping (sloping) bedrock layers show bands of different rock units, with the exposed rock being younger in the direction of dip. The bedrock in the western third of Pennsylvania is in nearly flat layers, but with a very slight southerly dip. This is indicated on the map by the large areas underlain by one age of rock, and by the gradual transition from older Devonian bedrock in the northwest through Mississippian and Pennsylvanian bedrock to younger Perm-

TOPOGRAPHIC MAP SYMBOLS

VARIATIONS WILL BE FOUND ON OLDER MAPS

Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Road under construction, alinement known
Proposed road
Dual highway, dividing strip 25 feet or less
Dual highway, dividing strip exceeding 25 feet
Trail

Railroad: single track and multiple track
Railroads in juxtaposition
Narrow gage: single track and multiple track
Railroad in street and carline
Bridge: road and railroad
Drawbridge: road and railroad
Footbridge
Tunnel: road and railroad
Overpass and underpass
Small masonry or concrete dam
Dam with lock
Dam with road
Canal with lock

Buildings (dwelling, place of employment, etc.)
School, church, and cemetery — Cem
Buildings (barn, warehouse, etc.)
Power transmission line with located metal tower
Telephone line, pipeline, etc. (labeled as to type)
Wells other than water (labeled as to type) — Oil, Gas
Tanks: oil, water, etc. (labeled only if water) — Water
Located or landmark object; windmill
Open pit, mine, or quarry; prospect
Shaft and tunnel entrance

Horizontal and vertical control station:
- Tablet, spirit level elevation — BM Δ 5653
- Other recoverable mark, spirit level elevation — Δ 5455

Horizontal control station: tablet, vertical angle elevation — VABM Δ *9519*
- Any recoverable mark, vertical angle or checked elevation — Δ *3775*

Vertical control station: tablet, spirit level elevation — BM × 957
- Other recoverable mark, spirit level elevation — × 954

Spot elevation — × *7369* × *7369*
Water elevation — *670*

Boundaries: National
- State
- County, parish, municipio
- Civil township, precinct, town, barrio
- Incorporated city, village, town, hamlet
- Reservation, National or State
- Small park, cemetery, airport, etc.
- Land grant

Township or range line, United States land survey
Township or range line, approximate location
Section line, United States land survey
Section line, approximate location
Township line, not United States land survey
Section line, not United States land survey
Found corner: section and closing
Boundary monument: land grant and other
Fence or field line

Index contour — Intermediate contour
Supplementary contour — Depression contours
Fill — Cut
Levee — Levee with road
Mine dump — Wash
Tailings — Tailings pond
Shifting sand or dunes — Intricate surface
Sand area — Gravel beach

Perennial streams — Intermittent streams
Elevated aqueduct — Aqueduct tunnel
Water well and spring — Glacier
Small rapids — Small falls
Large rapids — Large falls
Intermittent lake — Dry lake bed
Foreshore flat — Rock or coral reef
Sounding, depth curve — Piling or dolphin
Exposed wreck — Sunken wreck
Rock, bare or awash, dangerous to navigation

Marsh (swamp) — Submerged marsh
Wooded marsh — Mangrove
Woods or brushwood — Orchard
Vineyard — Scrub
Land subject to controlled inundation — Urban area

ian bedrock in the southwest. Regions in which the rock layers have been subjected to forces that caused them to fold are indicated when the bedrock units form narrow bands that repeat sequences such as youngest-oldest-youngest, etc. An excellent example of such an area is the northeast-southwest band from Lackawanna and Carbon counties in the northeast to Bedford and Fulton counties in the southwest. Faults are usually represented by a heavy line separating areas where the rock units are offset. Such features do not normally appear on a map of the scale of that on the inside front cover, although the southeastern portion of the state is an area of very complex folding and faulting. Igneous rock intrusions are also shown in that region, the best example being the Triassic diabase intrusions (black) cutting the Triassic sediments (crosshatch pattern) along a belt from Bucks County to Adams County.

The bedrock units represented on a geologic map are only those that lie nearest the surface. Topographic features, such as river valleys, can cause different units to be exposed and modify the patterns discussed above. Quarries and mines often enter older rock units that underlie those shown on the map. Additionally, geologic maps do not normally show the extent of loose soil, sand, or gravel that usually covers the bedrock, nor does it show the very thick layers of sediment that were deposited by glaciers and cover the bedrock in much of northern Pennsylvania.

A list of publications, available free from the Pennsylvania Geologic Survey, Department of Environmental Resources, Harrisburg, Pa. 17120, gives a detailed list of geologic maps and technical reports of nearly all information published by the Pa. Geological Survey and the U.S. Geological Survey for the Commonwealth. These reports and maps may be purchased from the State Book Store, P.O. Box 1365, Harrisburg, Pa. 17125, or copies of many of these reports can be examined in most of the college or university libraries around the state.

For the advanced collector, geologic maps can provide several useful functions. The maps, with their accompanying text, can provide valuable insight beyond knowing just *what* minerals are present at a locality, but *why these* minerals are at *this* spot. The text describes the nature of the rock and the unique combination of events that acted on it over millions of years to bring it to the condition in which we see it today. The map and accompanying cross sections show the geometric relationship that cause the rock to be exposed at this particular spot. Such information can be used to attempt to predict other locations where similar conditions might have led to similar mineral occurrences. But, beyond this, the added knowledge obtained can greatly enhance the appreciation of the unique character of each occurrence, and add greatly to the awareness of the significance of each specimen in a mineral collection.

ORGANIZING A COLLECTION

There should be three important steps between the field trip and the final resting place of a specimen in the mineral collector's possession. In order of performance these are 1) labeling in the field the location of each specimen, 2) the proper identification of each sample and 3) an orderly scheme of classification and arrangement for the whole collection. The last two steps can best be performed at home where ample time is available for a thorough study of the minerals which were collected.

Exact location information includes the nearest town, the property, quarry, or mine name, and perhaps the date when the samples were found. This information increases the value of a mineral collection. Whoever views your collection will want to know where a particular specimen was found, particularly if it is an unusual mineral. Although a mineral may not be rare, it may be rare for that locality. The location adds considerable value to the specimen, especially for any collector who is trying to collect a complete mineral suite from one location. There are many collectors who have discovered the fun of locality specialization. Another type of specialization, that of collecting crystal variations within a mineral group from many different localities, also requires accurate location data. Finally, there is the added geologic story which a known location adds to each specimen collected. Often a glance at the mineral and the location label will bring to mind the whole geologic picture of a collecting site. The locality descriptions given in this book are merely an introduction. Many Pennsylvania localities are world famous and have been described in great detail in other publications.

The second step, that of accurate mineral identification, cannot be overemphasized. Far too often, minerals have been casually misidentified, the incorrect name has spread, and eventually found its way into print where it is taken for fact. There are relatively few minerals that can be positively identified at a glance. Here is where a knowledge of basic geology, and the exact location of a mineral in question, is useful. This will enable the collector to determine which minerals "should" be present and which minerals "cannot possibly" be present. This then narrows the choice, and, with the aid of a text containing good mineral descriptions, correct identification is often possible.

The third step is that of classification. Most collectors prefer to use the Dana system (as used by Palache, Berman and Frondel), which is both a chemical and structural scheme. However, other systems and cross-filing are often useful. For example, special cards for mineral displays by location or by mineral origin can be useful and instructive. To do this, each mineral should be numbered and the numbers recorded together with location and date in a sequential log. Each collector should devise a system that fits his collection best.

MINERALS

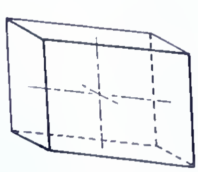
DEFINITION

A mineral is usually formed by natural, inorganic processes, has either a fixed chemical composition or a composition which is variable within narrow limits, and usually has a characteristic atomic structure. Although minerals normally form spontaneously by *natural* means, some industrial minerals and gems have been produced by man and are known as "synthetic" minerals. Examples include diamond, used as an abrasive and in phonograph stylii; quartz, used in communications equipment; and corundum, used as an abrasive. *Inorganic* processes include crystallization from liquids and gases, and alteration of older minerals by heat, pressure, or chemical reaction. Some minerals also form by organic processes, such as phosphate minerals formed by marine organisms and from bird guano and carbonate minerals formed by marine organisms. *Chemical composition,* for practical purposes, is usually "fixed". For example the mineral quartz has the chemical composition silicon dioxide. That a mineral has a *characteristic atomic structure* means that the atoms that make up the mineral have a definite geometric arrangement and order. This arrangement is responsible for the faces observed on crystals and for cleavage. Even minerals that do not show an outer crystal form or cleavage usually have a regular internal structure. Rarely, as in opal, the atoms are irregularly arranged and consequently no single crystals occur.

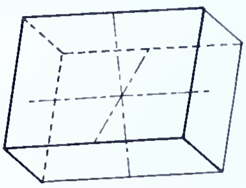
CRYSTALS

Mineral specimens are called "crystals" if they form with a characteristic shape bounded by planar surfaces that are reflections of the internal arrangement of atoms that make up the mineral. Crystals may range in size from submicroscopic (visible with an electron microscope) to many feet in length.

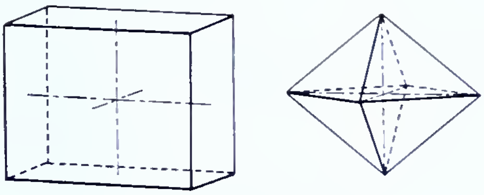
Crystals are distinguished by their symmetry, or crystal system, and by their general shape or form. Crystal systems



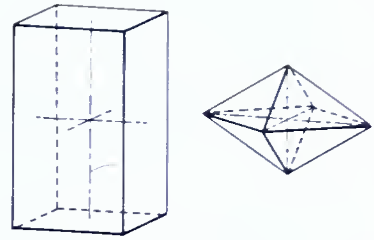
TRICLINIC
Pinacoids



MONOCLINIC
Pinacoids

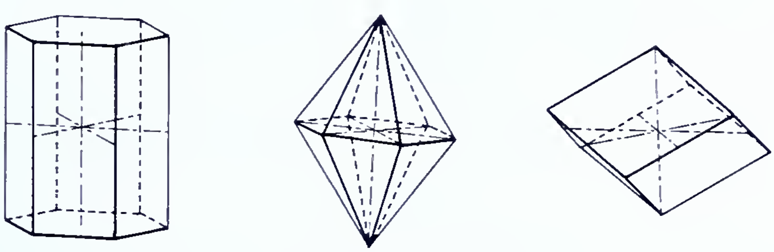


ORTHORHOMBIC
Pinacoids Dipyramid



TETRAGONAL
Prism Dipyramid

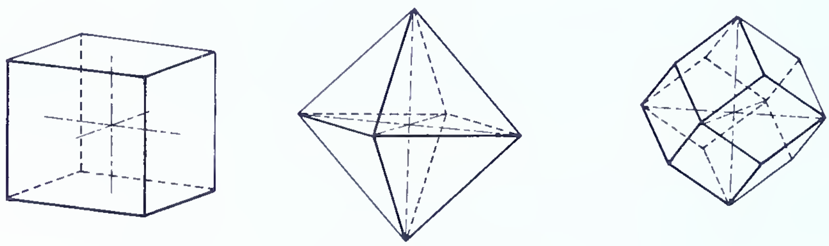
are defined by the length and position of the crystallographic axes, which are imaginary lines that pass through the center of a crystal parallel to the edges formed by the intersections of the major crystal faces. Crystals with the least symmetry are *triclinic,* all three axes are of different lengths, and no angles between axes are 90°. Crystals in the *monoclinic* system also have all axes of different lengths, however, two of the three angles between axes equal 90°. *Orthorhombic* crystals likewise



HEXAGONAL
Prism Dipyramid Rhombohedron

have all axes of different lengths, but all three angles between axes equal 90°. *Hexagonal* crystals have four axes. Three are of equal length and form angles of 120° with each other. The fourth is of a different length and forms a 90° angle with the other three. In *tetragonal* crystals, two of the three axes are of equal length, with the third of a different length. All angles between axes are 90°. *Isometric* crystals have the highest symmetry, with three axes of equal length and all angles between axes equal to 90°. Some of the more common forms in the above systems are illustrated.

Very well developed crystals are not common because conditions of growth must be suitable for their formation. In many cases the crystals are distorted and might have a combination of several forms. The intergrowth of two or more crystals as random aggregates or as well-organized crystal twins is also common. In addition, crystals may have particles of other minerals or liquids and gases, called "inclusions", inside them. Crystals may also be zoned, or show "phantoms", when the growth of the crystal was interrupted for a period of time or when the conditions of crystallization changed. This usually appears as an outline of the crystal shape within the crystal.



ISOMETRIC

Cube — Octahedron — Dodecahedron

HABIT

The habit of a mineral refers to the general form that the mineral may assume. This may be either a crystal form, such as those illustrated, or, if the mineral does not have a crystalline shape, some other form that is characteristic of the mineral. Descriptive terms commonly used to describe the habit of crystals include cubic, prismatic, pyramidal, rhombohedral (see figure on p. 13), tabular (flat and thin), acicular (or needle-like), radiating, fibrous, bladed (flat, broad and long), scalenohedral (a crystal with faces in the shape of scalene triangles) and lath-like.

Descriptive terms are also applied to minerals that do not develop into recognizable crystals. Included are such terms as massive (without external form, for example, a lump of clay), compact (usually a dense or tightly packed material that is also massive), botryoidal (a mineral with a surface consisting of spherical shapes, similar to a bunch of grapes), mammillary (rounded masses), reniform (rounded, kidney-shaped masses), dendritic (branching, tree-like), stalactitic (similar to an icicle).

Many minerals can occur in more than one habit, even at one locality. For example, four habits are listed for magnesite from the Cedar Hill quarry in Lancaster County: (1) "massive", (2) "globular clusters", (3) "small stalactitic pencils", (4) "crystals . . . probably scalenohedral with rounded faces and pencil shaped". In addition to forming in more than one habit, minerals that form by alteration sometimes take on the habit of the original mineral from which they formed. Such minerals are called "pseudomorphs" from the Greek words meaning "false form". An excellent example is the formation of "limonite" pseudomorphs after pyrite in Lancaster County.

PHYSICAL PROPERTIES

In addition to crystal system and habit, physical properties are features that immediately distinguish a mineral as different from others, and that are most commonly used for mineral identification. The determination of many of these properties requires little or no equipment.

Color: Besides habit, color is the first thing that one notices in looking at a mineral. However, color, taken alone, is often an unreliable characteristic. For example, quartz, though usually white or colorless, can be almost any color. The color of a mineral can be influenced by traces of impurity, radiation, and chemical bond.

Streak: The color of a mineral when it is powdered is not always the same as the color of the mineral specimen, is not as subject to variations, and is therefore a more reliable aid for identification. This color is referred to as the streak, and can be observed by rubbing the mineral specimen across a piece of white, unglazed porcelain called a streak plate.

Luster: The luster of a mineral is an expression of the way in which light is reflected off the surface and may be referred to as metallic, submetallic, or nonmetallic. Nonmetallic luster is subdivided to include: *vitreous,* the luster of glass; *adamantine,* brilliant, like the luster of diamond; *resinous,* bright but soft-looking, like resin; *earthy,* dull, like soil; *greasy, waxy, silky,* and *pearly*.

Specific gravity: The specific gravity or density of a mineral is the weight of a fixed volume of the mineral, usually given as grams per cubic centimeter, or the weight of the mineral compared with the weight of the same fixed volume of water (1 gram per cubic centimeter). Although measurement of specific gravity requires equipment of varying degrees of sophistication, large differences in specific gravity between minerals are easily determined by simply hefting the specimen to find whether it feels light, medium, or heavy when compared with an average rock of the same size. For example, quartz has a specific gravity of 2.65 and barite has a specific gravity of 4.48. By hefting both, a piece of barite should feel much heavier than a piece of quartz the same size.

Hardness: The hardness of a mineral is its resistance to being scratched. A substance of greater hardness is able to scratch a substance of lesser hardness. A scale of relative hardness (Mohs) is used for minerals, with numbers assigned from 1 to 10, 1 being softest, 10 hardest. The scale is: 1) talc, 2) gypsum, 3) calcite, 4) fluorite, 5) apatite, 6) orthoclase, 7) quartz, 8) topaz, 9) corundum, 10) diamond. Determination of hardness is simply a determination of what will scratch what. Some things that can be used for these determinations, in addition to mineral specimens of known hardness, are a fingernail (hardness ~ 2.5), a penny (hardness ~ 3), a pocket knife (hardness ~ 5), a piece of glass (hardness ~ 5.5), and a steel file (hardness ~ 6.5).

Cleavage: Some minerals break along certain directions in preference to other directions, and form smooth flat surfaces. This characteristic is called cleavage and is the result of the existance of planes of relative weakness in the internal arrangement of atoms. Perfect cleavage is the easiest to observe, forming smooth, flat surfaces. Imperfect cleavage often leaves a series of small, step-like parallel surfaces that may not be obvious unless the specimen is examined carefully. Cleavage can exist along one or more directions; the number of directions and the angles between them are important characteristics in mineral identification. Examples of minerals with perfect cleavage include the mica group (cleavage in one direction to form thin sheets), halite (cleavage in three directions to form cubes), and calcite (cleavage in three directions to form rhombohedrons).

Fracture: Minerals that do not have cleavage might still break in some characteristic way, although not along any particular plane. The way in which it breaks is called its fracture. Commonly observed types of fracture include *conchoidal* (producing a smooth, curved surface, like broken glass), *fibrous, hackly* (jagged), and *uneven* or *irregular.*

Magnetism: Only a small number of minerals are noticeably attracted by a magnet, a notable example being magnetite which sometimes even acts as a natural magnet (var. lodestone). Other minerals usually weakly attracted by a magnet include pyrrhotite and ilmenite.

Fluorescence: The identification of certain minerals may be aided by their emission of light when they are exposed to an ultraviolet lamp. This effect, like color, is not completely reliable because many minerals fluoresce only when they contain certain impurities. A world famous locality for fluorescent minerals, Franklin, New Jersey, is only 20 miles outside our state; however, many fluorescent minerals can be found in Pennsylvania.

Radioactivity: This property is a result of the decay of unstable atoms and is very useful for the location of minerals containing uranium or thorium such as carnotite or thorite. The determination of this property requires the use of a Geiger counter or some similar instrument.

MINERAL ASSOCIATIONS

To the novice mineral collector, the locations and associations of minerals usually seem to be bewilderingly random. As the collector advances, however, certain associations unconsciously improve his ability to find and identify minerals. At first, the collector may only search for closely related minerals as, for example, looking for chabazite in a diabase or hornfels already known to yield stilbite. Eventually, the collector will learn to utilize several types of associations. Some examples of these types are listed below.

1. Primary to Secondary Minerals

Observed Primary Mineral	*Secondary Minerals To Be Sought*
native copper	cuprite, malachite, azurite
galena	anglesite, cerussite
sphalerite	smithsonite, hydrozincite, hemimorphite
pyrite	melanterite
celestine	strontianite

2. General Host Rocks

Host Rock	*Minerals*
pegmatite	muscovite, schorl, beryl, spessartine, columbite, uraninite, microcline
ultramafic	antigorite, chromite, brucite, forsterite
marble	diopside, tremolite, graphite, phlogopite

3. Specific Types of Deposits (requiring a particular combination of factors in one area)

Deposit Type	*Minerals*
Cornwall type	magnetite, chalcopyrite, pyrite, calcite, grossular

Triassic zinc-lead-copper .... sphalerite, galena, chalcopyrite, malachite, pyromorphite, wulfenite, linarite, cerussite, ferroan dolomite, anglesite

Triassic hornfels with diabase ..... stilbite, natrolite, chabazite, chalcopyrite, epidote, grossular, laumontite

Williams Quarry type .... uraninite-thorianite, thorogummite, molybdenite, phlogopite, zircon

residual iron or manganese .... goethite, lepidocrocite, kaolinite, cryptomelane, pyrolusite, cacoxenite, beraunite

Alpine veins type .... actinolite, epidote, albite, adularia

4. Specific Geologic Formations

Formation	*Minerals*
Upper Bellefonte Formation	sphalerite
Lower Loysburg Formation	strontianite, celestine
Upper Tonoloway to Lower Keyser formations	calcite, sphalerite, galena, celestine, strontianite
Marcellus Formation	pyrite, melanterite, halotrichite, gypsum, pickeringite
Byram Formation gneiss	allanite, zircon, thorite
Catskill Formation	malachite, digenite, meta-autunite, metazeunerite
Curtin Formation	native sulfur

PENNSYLVANIA MINERAL SPECIES

(as of August 30, 1975)**

acanthite
actinolite
albite
allanite
allophane
almandine
alunite
alunogen
analcime
anatase
ancylite
andalusite
andersonite
andesine
andradite
anglesite
anhydrite
anorthite
antigorite
anthophyllite
apophyllite
aragonite
arsenopyrite
artinite
augite
aurichalcite
azurite
babingtonite
*bararite
barite
bastnaesite
beraunite
*berndtite
beryl
beta-uranophane
bianchite
billietite
biotite
bismuthinite
bismutite
beohmite
boltwoodite
bornite
*boussingaultite
brochantite
brookite
brucite
bytownite
cacoxenite
calcite
cancrinite
carnotite
*cassiterite
celestine
cerussite
chabazite
chalcanthite
chalcocite
chalcopyrite
chevkinite
chloritoid
chondrodite
chromite
chrysocolla
chrysotile
clausthalite
clinochlore
clinozoisite
cobaltite
coffinite
columbite
conichalcite
copiapite
copper
cordierite
corkite
cornubite
corundum
covellite
crandallite
*cryptohalite
cryptomelane
cuprite
datolite
descloizite
devilline
diaspore
dickite
digenite
diopside
djurleite
dolomite
*downeyite
dravite
dumortierite
enargite
enstatite
epidote
epsomite
erythrite
fayalite
ferrimolybdite
ferroaxinite
fluorite
fluorapatite
forsterite
gahnite
galena
gersdorffite
gibbsite
gismondine
glaucodot
glauconite
goethite
gold
goslarite
graphite
greenockite
grossular
gypsum
halite
halloysite
halotrichite
harmotome
hedenbergite
hematite
hemimorphite
*herzenbergite
heulandite
*hexahydrite
hinsdalite
hisingerite
hornblende
huntite
hyalophane
hydromagnesite
hydrozincite
hypersthene
ice
illite
illmenite
ilvaite
jarosite
jordanite
kalinite
kammererite
kaolinite
kasolite
kieserite
kyanite
labradorite
langite
lansfordite
lanthanite
laumontite
lepidocrocite
liebigite
linarite
lizardite
magnesite
magnetite
malachite
manganaxinite
marcasite
margarite
marialite
*mascagnite
meionite
melanterite
mesolite
meta-autunite
metatorbernite
metazeunerite
microcline
millerite
mimetite
mirabilite
molybdenite
monazite
montmorillonite
morenosite
*mullite
muscovite
natrolite
nepheline
nesquehonite
nitrocalcite
nontronite
nsutite
oligoclase
opal
orthoclase
*ottemannite
palygorskite
paragonite
pectolite
penninite
pentlandite
phillipsite
phlogopite
phosphuranylite
pickeringite
piemontite
pigeonite
plumbojarosite
posnjakite
*potash alum
prehnite
pseudomalachite
pumpellyite
pyrite
pyroaurite
pyrolusite
pyromorphite
pyrope
pyrophyllite
pyrrhotite
quartz
ramsdellite
*realgar
retgersite
riebeckite
rockbridgeite
rosasite
rozenite
rutile
*salammoniac
sauconite
scheelite
schorl
schroeckingerite
scorodite
*selenium
sepiolite
siderite
sillimanite
silver
sklodowskite
smithsonite
spessartine
sphalerite
spinel
starkeyite
staurolite
stilbite
stilpnomelane
strengite
strontianite
sulfur
susannite
talc
tennantite
tenorite
tetrahedrite
thaumasite
thomsonite
thorianite
thorite
thorogummite
titanite
tremolite
*tschermigite
turquoise
tyuyamunite
ulvospinel
uraninite
uranophane
uranospinite
vanadinite
vandendriesscheite
variscite
vermiculite
vesuvianite
violarite
vivianite
wavellite
weeksite
wollastonite
wolsendorfite
wulfenite
wurtzite
zaratite
zircon
zoisite

*Minerals found in Pennsylvania only in circumstances such that some mineralogists would regard them as not fulfilling all of the requirements to be defined as minerals. Finkelman and others (1974), Observations on minerals from burning anthracite seams and culm in Pennsylvania [abs.], Geol. Soc. America Abs. with Programs, v. 6, p. 27-28.

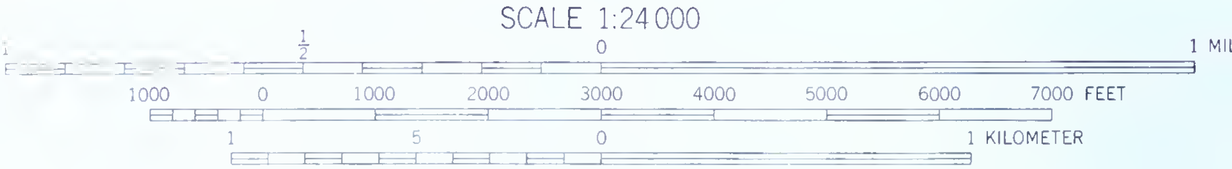
**Adapted from research of Arthur Montgomery and Raymond W. Grant.

SELECTED MINERAL COLLECTING LOCALITIES

GLEN MILLS QUARRY

EXPLANATION FOR COLLECTING LOCALITY SECTION

LOCATION MAPS



Scale for all location maps unless otherwise stated.

North is always toward the top of the page unless otherwise noted.

MINERAL LISTS

Relative abundance are indicated as follows:

- CALCITE — *most abundant*
- Magnetite — *moderately abundant*
- Cacoxenite: rare — *not abundant*
- Halotrichite: very rare — *very rare, a few specimens reported*

Other notations used include the following:

- Metatorbernite(?) — *may be reported but was not verified*
- "Deweylite" — *vaguely defined species*
- Goethite: "limonite" — *vaguely defined mixture containing primarily the species to left of colon*
- Titanite (sphene) — *name in parentheses is a commonly used unofficial name for species*
- Clinochlore (chlorite group) — *species is a member of the common group shown in parenthesis*
- Quartz: var. chalcedony — *species to left of colon is present as a particular variety*

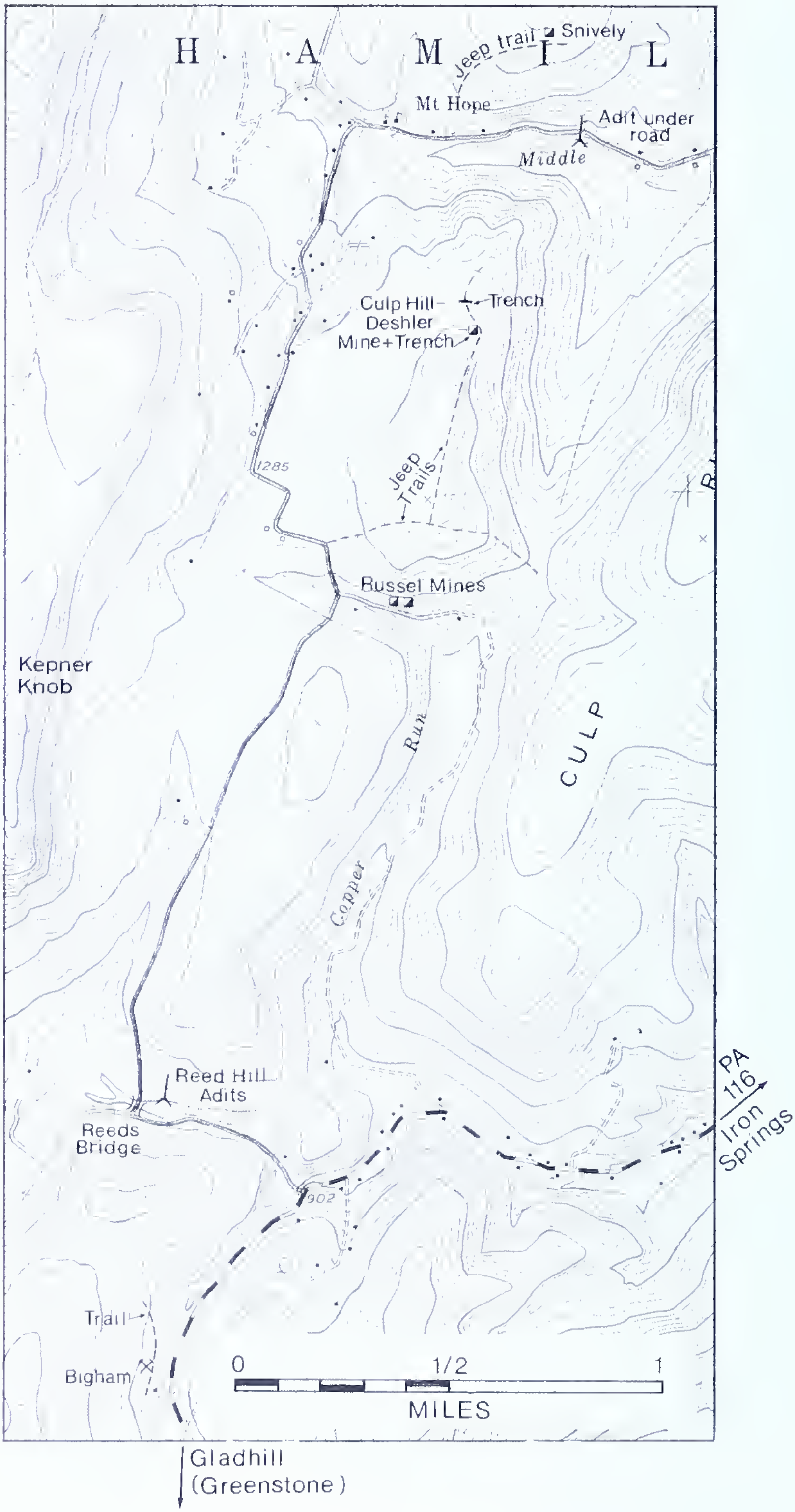
NATIVE COPPER LOCALITIES

LOCATION

At present, there are five native copper localities in the Mt. Hope-Gladhill area accessible to mineral collectors. These are the Snively (Musselman), Culp Hill (Deshler), Russel, Reed Hill and Bigham prospects. Each is in Hamiltonban Township on the Iron Springs quadrangle. WARNING: several species of snakes, including the copperhead, are common in the area, be careful.

The Snively mine is owned by Mr. Mickley, who lives east of Mt. Hope, and one must obtain permission before collecting here. It is best entered by a north to northeast trail which leaves the Mt. Hope-Virginia Mills road 0.3 mile west of the "pyrophyllite" quarry. About 600 feet up the trail, the trail branches; take the right branch to the mine dumps across the nose of the hill. Another set of mineralized small pits and trenches is located about 500 feet northeast of the Snively dumps.

The Culp Hill, Russel, and Reed Hill prospects are owned by the P. H. Glatfelter Paper Company of Spring Grove and permission is necessary to enter these properties. The Culp Hill prospect requires a two mile (round trip) hike up Culp Hill. It is best reached by walking the logging trails from the southwest. The trail leaves the road 1.15 miles (via auto) south of Mt. Hope and cuts through the dumps and between the shaft (west side) and trench (east side). A second trench crosses the trail about 500 feet north of the Culp Hill prospect but is rather barren.


H A M I L
Snively
Jeep trail
Mt Hope
Adit under road
Middle
Culp Hill-Deshler Mine+Trench
Trench
Jeep Trails
1285
Russel Mines
Kepner Knob
Run
CULP
Copper
Reed Hill Adits
Reeds Bridge
902
PA 116
Iron Springs
Trail
Bigham
0
1/2
1
MILES
Gladhill (Greenstone)

The Russel prospect consists of two shafts and two dumps, each about 100 feet apart. The western dumps, which seem to contain more copper, are located on the north side of a trail about 700 feet east of the road between Mt. Hope and Reeds Bridge. The trail leaves the road about 1.3 miles south (via auto) of Mt. Hope. The Russel prospect area is 900 feet northwest of the pond on Copper Run. The Bechtel shaft was reported to be located several hundred feet northeast of the Russel, but it has not been found.

The Reed Hill prospect is best entered by using an eastward trail which leaves the north-south public road 90 feet north of Reeds bridge. The dumps are located 330 feet east of this road and the entrance to the old adit is 175 feet north of the dumps, through a trench about 15 feet deep and 145 feet long. Some copper mineralization also occurs in float boulders down the creek from the mine.

The Bigham prospect is located about 400 feet west of the Greenstone-Iron Springs Road, 1.0 mile north of Greenstone. Excellent cutting and polishing material may be found here. A fee is charged by the owner, Mr. Stanley Pitts, and the amount of material you remove will be limited.

The Bechtel and Watson mines were not located. Thus, there is potential for additional collecting sites.

MINERALS

Amphibole group: asbestos; possible var. crocidolite

Azurite: bright blue coatings, uncommon except at Snively

Calcite: white cleavages common in metabasalt

Chlorite group: unknown species; blue-green scales and flakes

COPPER: native; commonly disseminated in epidote (Snively), quartz-calcite veins (Russell and Reed Hill), or chlorite schist; much of the copper is too fine-grained to be seen without slabbing

Cuprite: deep red to orange, usually surrounding native copper

EPIDOTE: massive green in the metabasalt; also radiating clusters in vugs

MALACHITE: green coatings; small crystals from the west side of the "pyrophyllite" quarry

QUARTZ: milky vein quartz; pink quartz from the Russel mine dumps; red jasper as pea-like grains in vesicles in metabasalt

Snively mine dumps

GEOLOGY

The native copper deposits of Adams County occur in metamorphosed Precambrian volcanic rock. Those which were originally basalt lava flows have been altered to greenstone also called metabasalt. The green color of these rocks is derived from the epidote and chlorite they contain, rather than from copper. Another metamorphosed volcanic rock in the area is metarhyolite, a lilac-colored rock. Some metarhyolite contains beautiful red-lilac piemontite but seldom contains copper.

Native copper was formed from chloride-bearing aqueous solutions released during the metamorphism of basalt at greater depth. Copper was leached from the deep, hot dry rocks and added to the cooler, near surface rocks which were undergoing hydration. Recent, near surface alteration of native copper has produced the brightly-colored secondary copper minerals. Most of the prospects occur near contacts of the greenstone with other rocks or where the greenstone has been sheared. These are the areas where copper-bearing solutions could penetrate the solid greenstone.

SIMILAR OCCURRENCES

The Keweenawan copper deposits of Michigan

REFERENCES

Bevier, G. M. (1914), *The present status of the copper development in the South Mountain region,* Pa. Geol. Survey, 3rd ser., Biennial Rept., Appendix C.

Frazer, Persifor, Jr. (1880), *The geology of Lancaster County,* Pa. Geol. Survey, 2nd ser., Rept. CCC, p. 304-314.

Stose, G. W. (1910), *The copper deposits of South Mountain in southern Pennsylvania,* U.S. Geol. Survey, Bull. 430, p. 54.

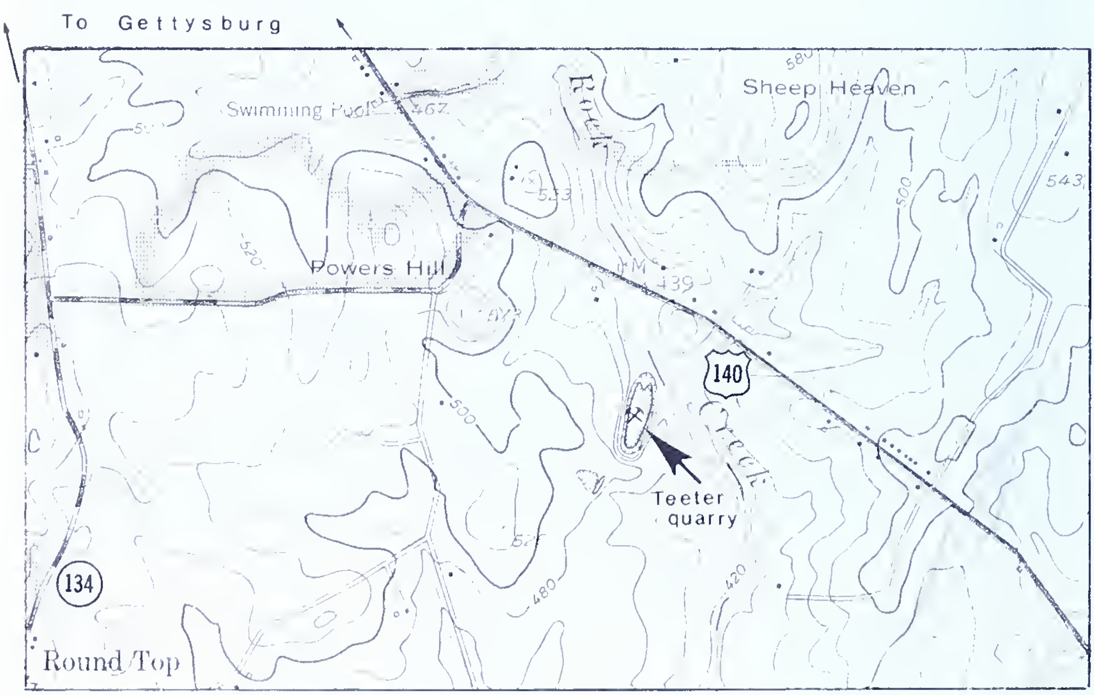
Stose, G. W. and Bascom, Florence (1929), *Fairfield-Gettysburg folio, Pennsylvania,* U.S. Geol. Survey Geologic Atlas Folio 225, 34 p.

Wherry, E. T. (1911), *The copper deposits of Franklin-Adams Counties, Pennsylvania,* Jour. Franklin Institute, p. 151-163.

TEETER QUARRY ZEOLITE LOCALITY

LOCATION

The Teeter quarry is an active quarry operated by the Harry Campbell Company. It is located south of U.S. Route 140, approximately 1.5 miles southeast of the Gettysburg Borough boundary in Cumberland Township, on the Gettysburg topographic map. Permission to enter this active quarry is required, and collecting is allowed only on Saturday morning from 8 a.m. to noon and on weekdays from noon to 1 p.m. and from 4 p.m. to 5 p.m. It is requested that groups of collectors be kept to 15 or less.



MINERALS

ANDRADITE (garnet group): massive, brown veins up to one foot thick reported; also crystals up to 1.5 inches

BORNITE: orange-brown; metallic when fresh, tarnishes rapidly to peacock blue; with chalcocite in epidote-rich skarn

CALCITE: white- to tan-colored rhombohedral crystals and cleavage rhombs; some fluorescent, rare

Chabazite: white rhombs; flesh-colored rhombs reported

CHALCOCITE: soft gray-blue metallic blebs intergrown with bornite in epidote-rich skarn

Chalcopyrite: uncommon; brassy yellow masses up to 4 inches in garnet-rich skarn

Chrysocolla: bluish green; associated with weathering copper sulfides

Djurleite: uncommon; gray, metallic masses with chalcopyrite in garnet-rich skarn

Epidote: dark green; massive and in prismatic crystals up to ½ inch long

Garnet group: see andradite

Goethite: as "limonite" pseudomorphs after pyrite; rare; in hornfels

Hematite: var. specular; also as overgrowth of tiny octahedrons

Heulandite: white; coffin-shaped crystals

Laumontite: var. "leonhardite"; chalky and dull, weathered; unweathered material might contain fresh laumontite

Magnetite: abundant; platy pseudomorphs after hematite

MALACHITE: coatings; also divergent groups of acicular crystals

Natrolite: uncommon; small, white crystals

Orthoclase: pink to white crystals lining vugs in epidote skarn

Pyrite: rare; cubic crystals in hornfels
Pyrolusite: dendrites
Quartz: vein material; also milky crystals up to 1 inch long, some with epidote crystals
STILBITE: white to pale-yellow sheaves and single crystals; also in white stellate rosettes originally misidentified as pectolite; usually found in small vugs
Titanite (sphene): tiny yellow or light brown; with quartz and epidote
Tremolite: white fibrous material in vugs with epidote

GEOLOGY

This quarry is in the Gettysburg shale, which was deposited during the Triassic Period. Nearby, magma intruded from depth later during the Triassic, forming diabase. The intense heat of the magma literally baked the shale to form a rock called hornfels, seen in the quarry today. Most of the collectable minerals were crystallized from solutions that penetrated the shale at the time of the magmatic intrusion. The secondary minerals, such as malachite and pyrolusite, formed later by the alteration of the primary minerals through the action of ground water.

REFERENCE

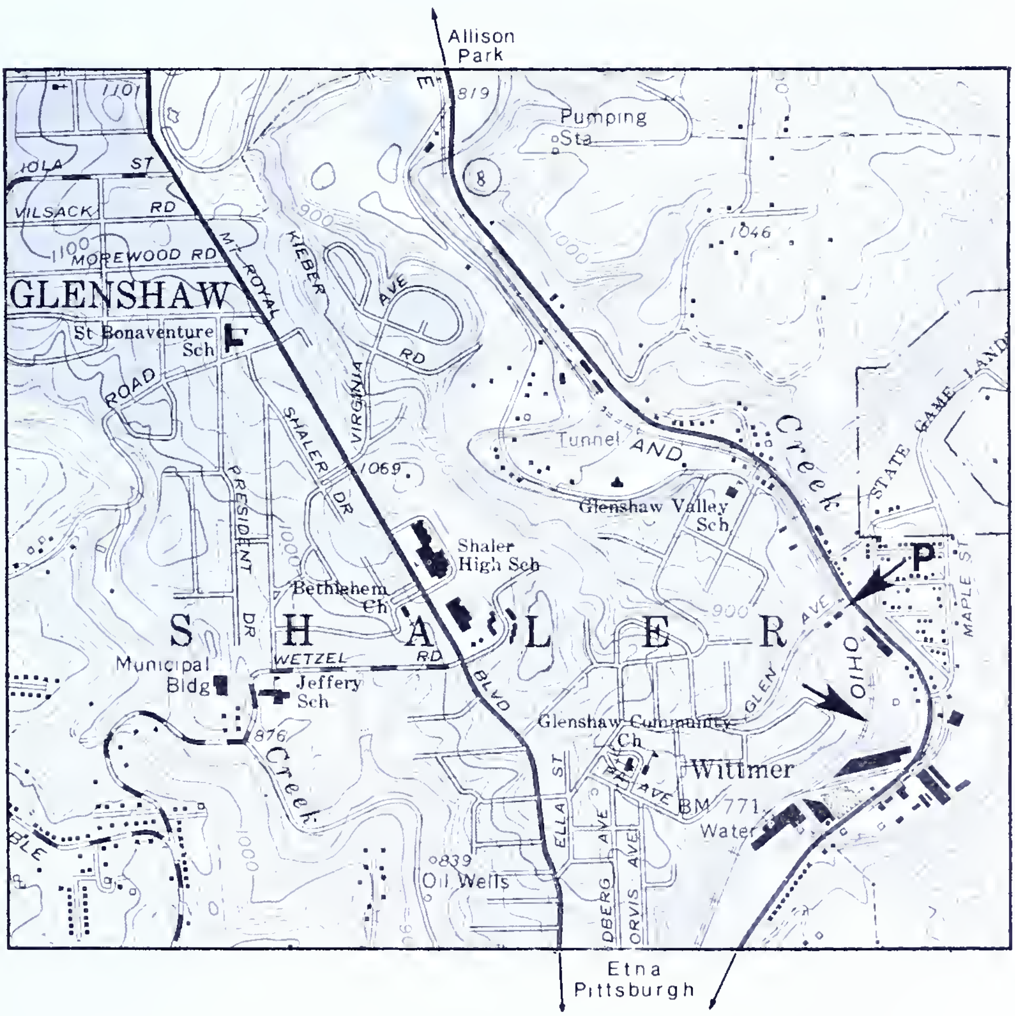
Hoff, D. T. (1975), personal communication, Earth Science Curator, William Penn Memorial Museum, Harrisburg.

NOTES

WITTMER WURTZITE LOCALITY

LOCATION

This locality is along railroad tracks near the Glenshaw glass factory in the community of Wittmer on the Glenshaw quadrangle. It is best reached by parking at a small factory at the point where Glen Avenue makes a sharp turn ("P" on map) and walking south along the railroad. Do not enter this private property without first obtaining permission.



MINERALS

Barite: in concretions at south end of exposure
Calcite: in concretions at center and north end of exposure
Chalcopyrite: small tetrahedrons
Marcasite: usually not distinguishable
Pyrite: small cubes
SIDERITE: forming nodules 2 to 4 inches across
Sphalerite: cleavage fragments and some crystals; curved and platy
Wurtzite: small, brownish-red crystals in concretions; as hexagonal pyramids and rhombohedrons; some as rare 15R polymorph

GEOLOGY

All of the collectable minerals observed at this locality are found in shrinkage cracks in concretions of siderite. The concretions probably formed under marine conditions at the time that the enclosing shale was being deposited. The minerals in the nodules are believed to have formed at the time the shale was being lithified, or through introduction by ground water at a later time. The nodules here are in the Glenshaw Formation of the Pennsylvanian Conemaugh Group, just above the Brush Creek limestone. This is the type locality for the very rare 15R polymorph of wurtzite.

SIMILAR OCCURRENCES

East Unity Church and Sedwicks Mill, Butler County; Shelocta, Indiana County; Sugar Hill, Jefferson County; Franklin, Venango County; and Donohoe, Westmoreland County.

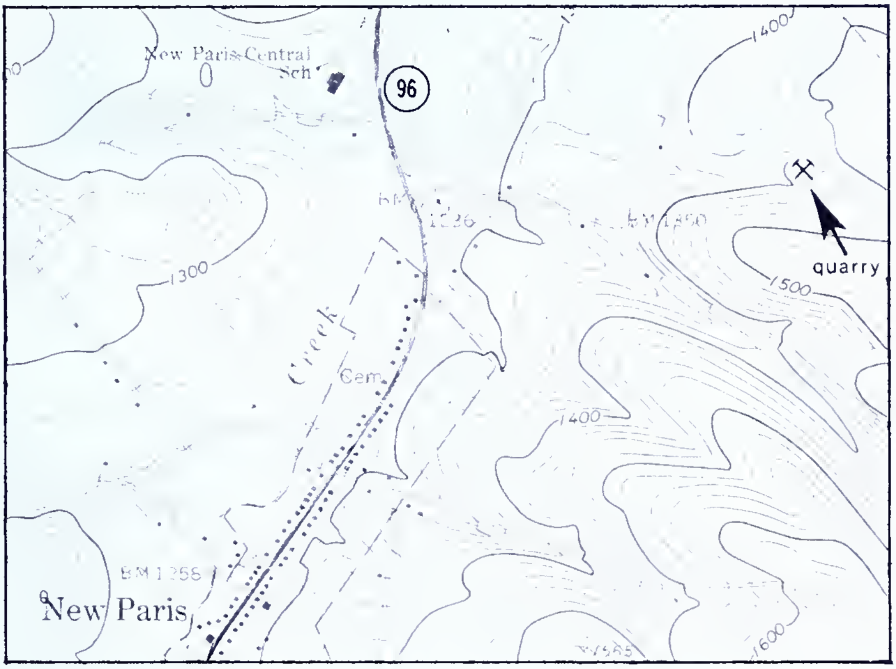
REFERENCES

Frondel, Clifford and Palache, Charles (1950), *Three new polymorphs of zinc sulfide*, Am. Mineralogist, v. 35, p. 29-42.
Seaman, D. M. and Hamilton, Howard (1950), *Occurrence of polymorphous wurtzite in western Pennsylvania and eastern Ohio*, Am. Mineralogist, v. 35, p. 43-50.

NEW PARIS FLUORITE LOCALITY

LOCATION

The Bedford County Stone and Lime Company quarry is located 1.1 miles northeast of New Paris, Napier Township, in the northeast corner of the Schellsburg quadrangle. The quarry is owned by Mr. Gene Niehenke, from whom permission to enter is required.



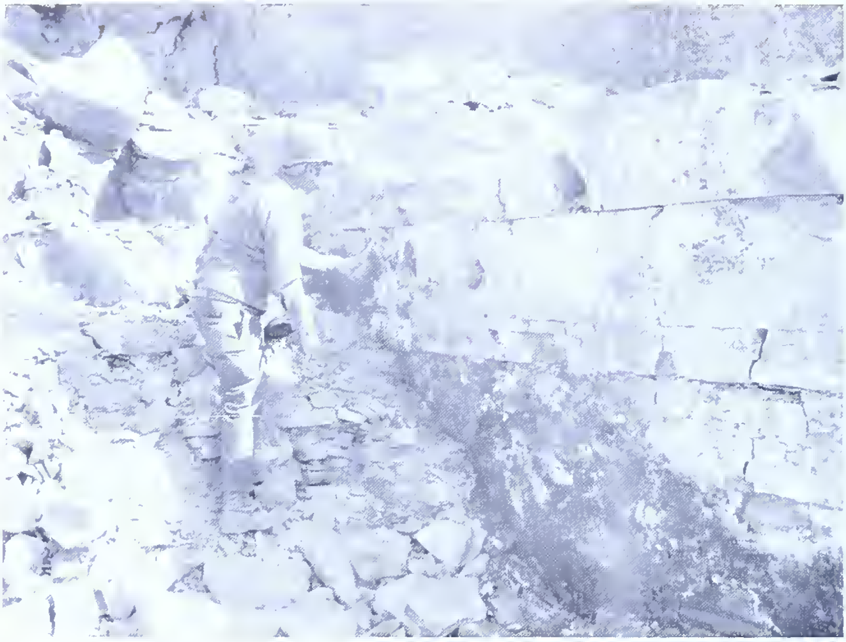
MINERALS

CALCITE: white cleavages in veins

FLUORITE: beautiful cornflower-blue, green, yellowish, and purple cubic crystals and cleavages up to 1 inch in some veins; single cleavages are often zoned with two distinct colors

Halite(?): microscopic cubic crystals in fluid inclusions in fluorite

Strontianite: rare; white needle-like crystals; probably the calcian variety.



Vertical joint face covered with blue, green and purple fluorite from the New Paris quarry

GEOLOGY

The fluorite occurs in nearly vertical calcite veins which trend north-northeast. These veins have filled in a set of joints (parallel fracture surfaces with no movement along the fractures) which are readily visible across the quarry floor. The host rock for the veins is laminated limestone, probably of the lowermost Keyser Formation (Silurian-Devonian age). About 6 feet above the area from which fluorite was collected in 1974, there is a bench with abundant marine fossils.

Roadcuts near Fishertown, about 3.5 miles southeast of New Paris, yield gray, crystalline barite nodules.

SIMILAR OCCURRENCES

Chimney Rocks, Hollidaysburg

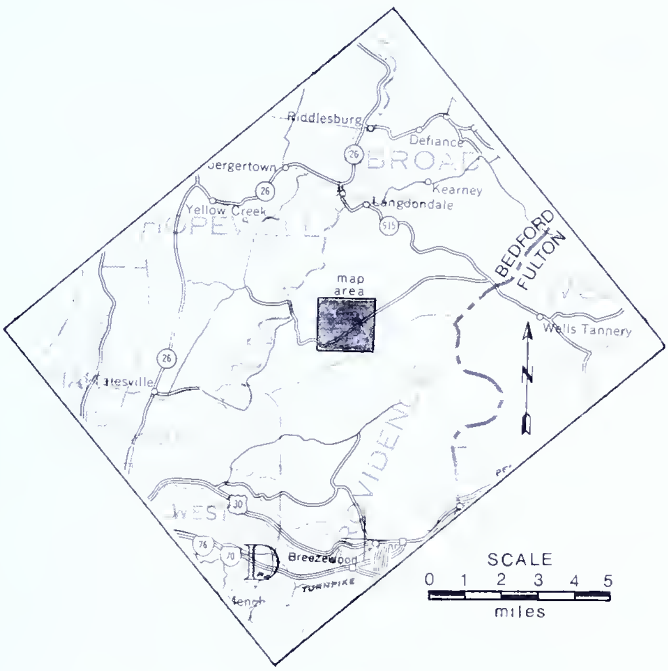
REFERENCE

Smith, R. C., II, and Way, J. H., Jr. (1973), *Multi-colored fluorite at New Paris*, Pennsylvania Geology, v. 4, no. 6, p. 16.

SHERMAN VALLEY CRYPTOMELANE LOCALITY

LOCATION

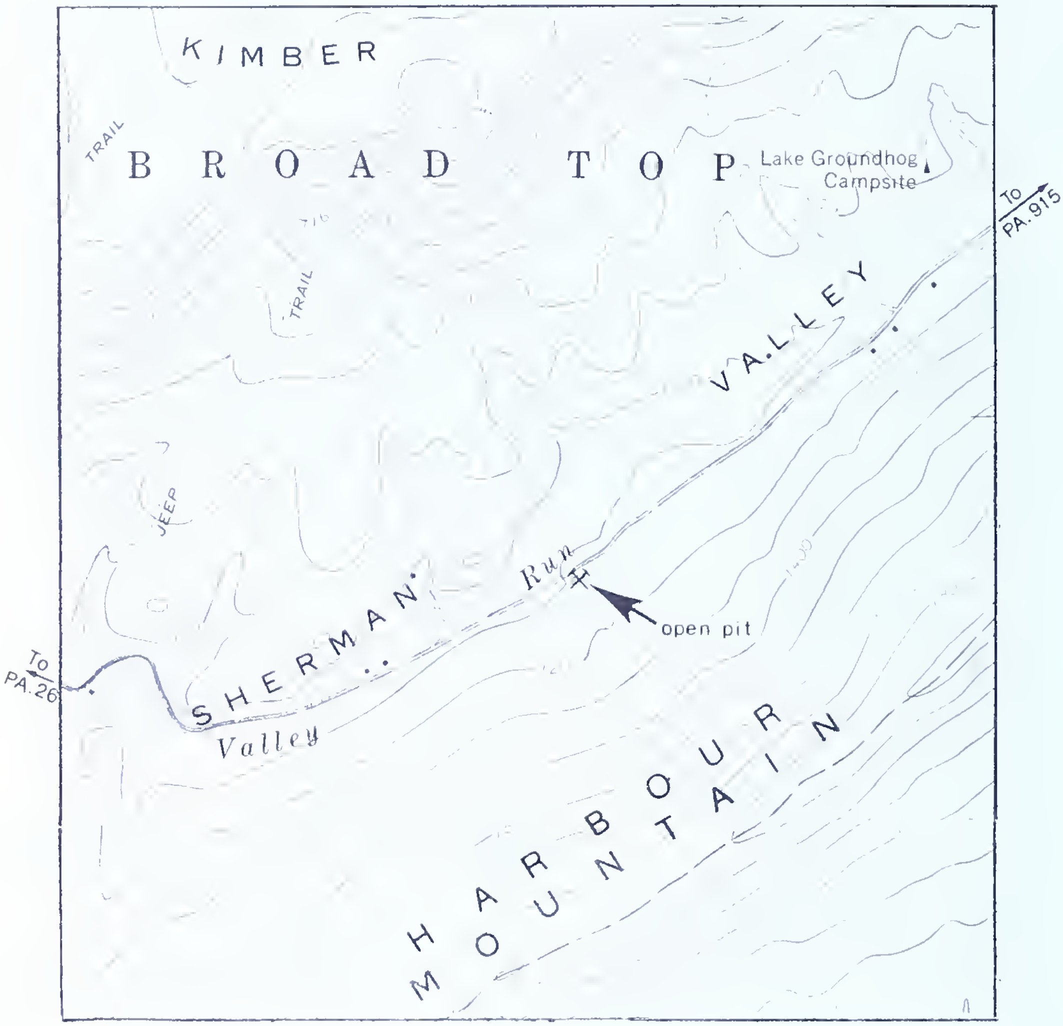
Sherman Valley is located between Harbor Mountain and Kimber Mountain in Broad Top Township in the Everett East quadrangle. The Coles-Simon open pit, shown as a small depression on the topographic map, is on the southeast side of the road about 1 mile southwest of Camp Groundhog. This manganese prospect area is located 5.5 miles north of Breezewood and 5.2 miles northeast of Tatesville. Because the open cut and dumps are on a tree farm, permission must be obtained from the owner.



MINERALS

Chalcopyrite: reported to occur in trace amounts as tiny, rounded grains in the shale; not observed in hand specimen.

CRYPTOMELANE: hard, steel blue-gray, submetallic, botryoidal; in vugs up to a few inches and as metallic, radiating sprays



GOETHITE: shiny black; mammilary in vugs; shows a deep red-brown color on thin edges with intense light
Pyrolusite: soft, sooty black areas which write on paper; possibly also as metallic, needle-like masses of radiating sprays

GEOLOGY

The Coles-Simon prospect described here consists of a semi-circular open cut, a few caved-in stopes, and several bulldozer trenches and dumps. Foose (1945) described the prospect in detail and reported a production of 600 tons of ore ranging from 10% to more than 45% manganese.

The manganese minerals occur in the topmost sandstone of the Pocono Formation and in the basal red shale and sandstone of the Mauch Chunk Formation, both of Mississippian age. The limestone present between these formations a few miles to the southwest is absent here. The absence of this limestone, by either non-deposition or erosion, is called a disconformity. In this case, the disconformity may be related to a climatic change which helped concentrate the manganese from the red shale into ore minerals. The manganese was probably remobilized by reducing (oxygen poor), non-alkaline ground water and concentrated in certain, replaceable shale beds.

REFERENCE

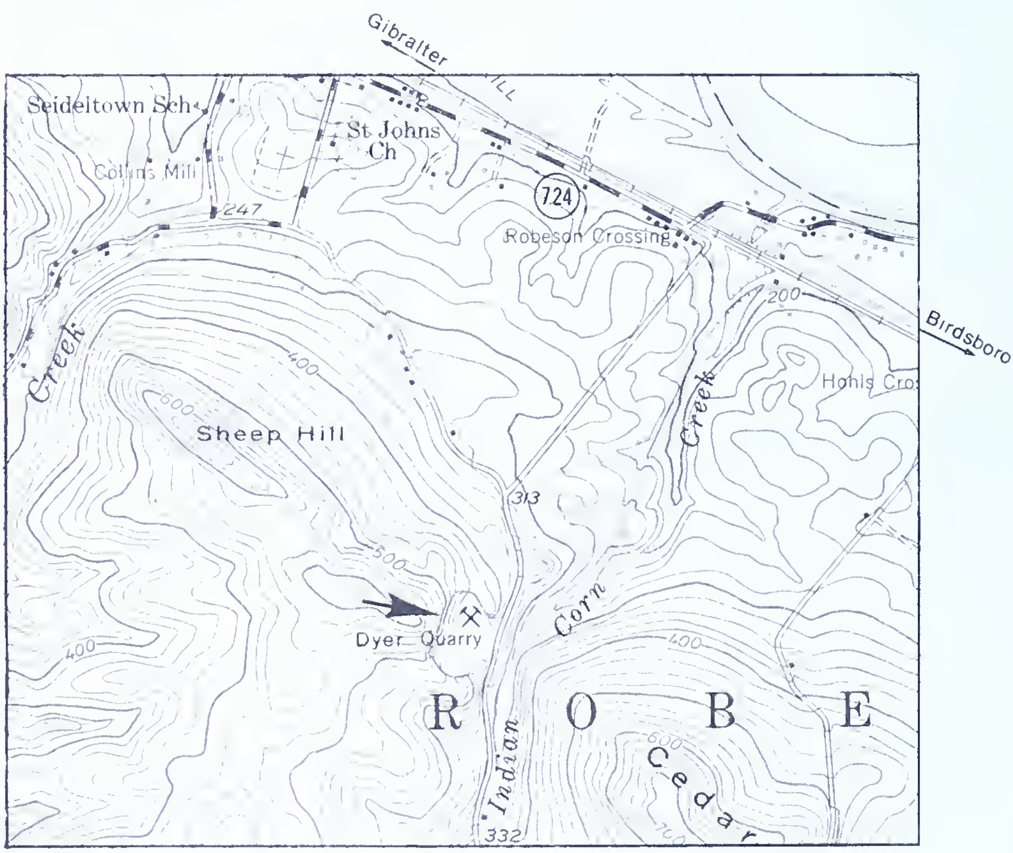
Foose, R. M. (1945), *Manganese minerals of Pennsylvania,* Pa. Geol. Survey, 4th ser., Min. Resource Rept. 27, p. 47-74.

NOTES

DYER QUARRY ZEOLITE LOCALITY

LOCATION

The John T. Dyer quarry (Warner Company) is located on Quarry Road on the west side of the gap of Indian Corn Creek through Sheep Hill-Cedar Hill. This area is 1.5 miles southeast of Gibralter and 2.5 miles west of Birdsboro, Robson Township, in the Birdsboro quadrangle. Permission to collect after weekday working hours should be sought from



the office east of Quarry Road and the crusher plant. Releases must be signed. Hard hats and safety glasses are required. Collecting on Sunday mornings by clubs may be permitted. Clubs should contact the company in advance. WARNING: one should stay out of the back corners of the upper level; they are dangerous.

MINERALS

Actinolite (amphibole group): dark-green blades with golden calcite; also the variety byssolite as hairs with prehnite

Amphibole group: see actinolite

Apophyllite: colorless or white tabular to pseudocubic crystals with byssolite

Babingtonite: rare; splendant, blade-like asymmetric crystals; in veins with epidote from the south face of the lower level; in veins with cobaltite and prehnite

Bornite(?): reported

CALCITE: brilliant, pale to golden-yellow rhombohedrons

Chabazite: beautiful colorless and flesh-colored crystals up to ½″ with stilbite; museum quality

Chalcopyrite: small blebs in veins in south and east face of quarry; disphenoid crystals reported

Chrysocolla(?): blue-green with bornite(?)

Cobaltite: rare; in prehnite veins; associated with erythrite and chalcopyrite; probably the material listed as arsenopyrite by Gordon (1922)

Epidote: pistachio-green microcrystals

Erythrite: rare; peach-blossom colored coatings with cobaltite

Hematite: small specular scales

Heulandite: colorless to golden-yellow, coffin-shaped crystals

Laumontite: chalky, dead-white prismatic crystals in radiating clusters

Magnetite: micro-octahedrons with byssolite

Natrolite: colorless to white terminated needles; also radiating sprays

Opal: colorless to light-blue coatings with calcite; also massive

Prehnite: colorless to green crystals; mammillary clusters

Pyrite: massive and cubic microcrystals

Quartz: colorless, milky and amethystine microcrystals

Reibeckite: var. crocidolite; reported as pale-blue fibrous coatings on altered diabase

STILBITE: abundant; colorless, white, and yellow prismatic crystals; usually in sheaf-like radiating aggregates; up to museum quality

Stilpnomelane (chalcodot): reported as bronze platy crystals with calcite

Thomsonite(?): colorless to white, slender prisms

TITANITE (sphene): common; micro; golden flat wedges with byssolite and in altered diabase

GEOLOGY

The Dyer quarry at Gibralter, formerly known as the Gickerville quarry, is situated entirely in an instrusion of diabase. The diabase, composed of roughly equal amounts of plagioclase and pyroxene, was intruded during Triassic time about 195 million years ago. Three and one-half miles to the north the same magma broke through to the surface to form the arc-shaped Jacksonwald lava flow. This lava flow was noted for its datolite (Wherry, 1910).

During the tens-of-thousands of years required for cooling of the diabase exposed at the Dyer quarry, water and other volatiles accumulated, while dry minerals crystallized. Before the cooling was complete, water escaped along fractures and redistributed several elements to form crystals in the deuteric veins. Deuteric means simply that the veins formed during the late stages of cooling and that the necessary water and elements probably came from the diabase itself.

Although not attractive enough to interest most mineral collectors and distinguishable only with a microscope, the York Haven type diabase at Dyer's probably contains augite, fluorapatite(?), hypersthene, ilmenite, labradorite, magnetite, pigeonite, and ulvöspinel.

Good crystal specimens of chabazite and stilbite are infrequently encountered because of the unusually small number of alteration veins at Dyer's. The quarry can almost always be counted on for good microcrystals.

REFERENCES

Gordon, S. E. (1922), *The mineralogy of Pennsylvania,* Acad. Nat. Sci., Philadelphia Spec. Pub. 1, p. 158.

Montgomery, Arthur (1970), *Pennsylvania minerals No. 95,* Mineralogical Soc. Pa., Keystone Newsletter, v. 19, no. 11, p. 9-10. (Includes list of Dyer quarry minerals by Robert M. Eisenhauer.)

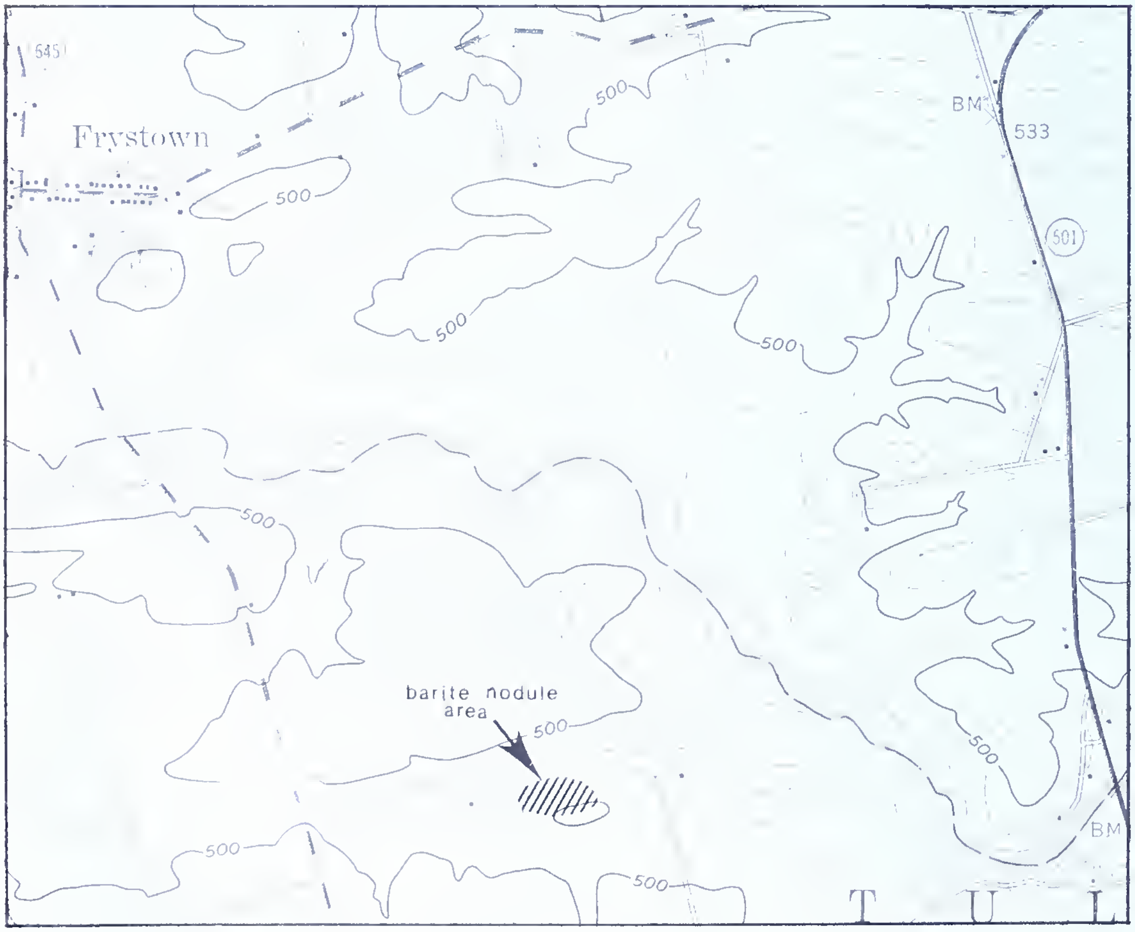
Wherry, E. T. (1910), *Contributions to the mineralogy of the Newark group in Pennsylvania,* Trans. Wagner Free Inst. Sci., 7, p. 7-27.

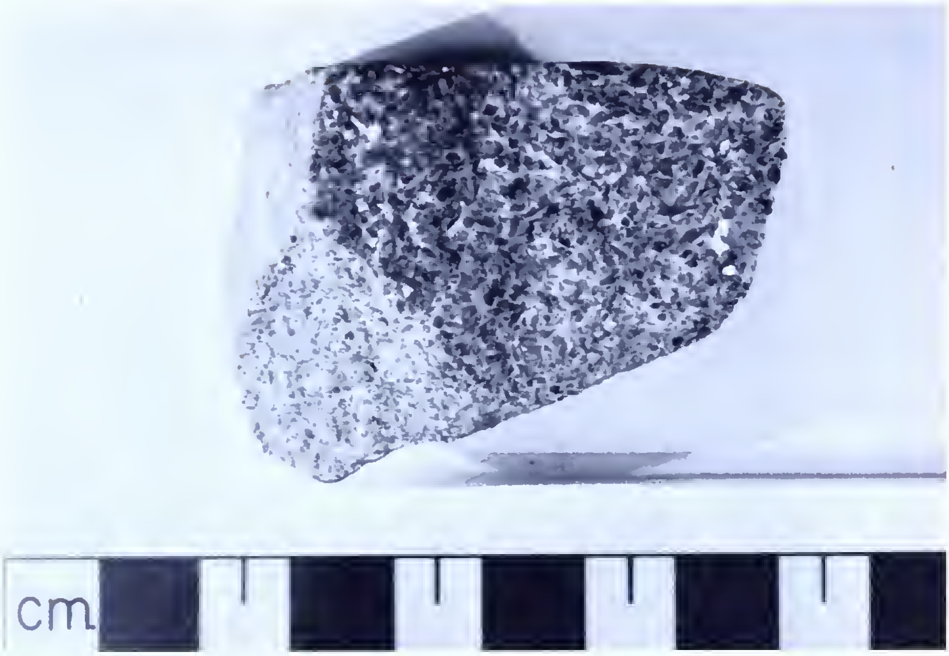
NOTES

FRYSTOWN FETID BARITE LOCALITY

LOCATION

The Frystown barite nodule occurrence is on the Roy McLain farm (formerly R. and M. Frantz farm) located 1.4 miles southeast of Frystown, Tulpehocken Township, in the Bethel quadrangle. The main area of barite is about 1,000 feet west of the McLain house and there is a lesser concentration about 500 feet north of the house. The farm is located between Pa. Routes 645 and 501 south of Little Swatara Creek. The occurrence is in cultivated fields, so collecting is possible only during those times when crops are not planted. It is absolutely necessary to have the owner's permission to enter the property and a fee may be requested.





Barite mass composed of small tabular crystals from Frystown area

GEOLOGY

The host rock has customarily been referred to as the Middle Ordovician Martinsburg Formation. Here, however, the Martinsburg may include older, transported carbonate rocks.

The barite nodules were formed in deep, stagnant, sulfate-bearing marine sediments. These were apparently permeated by barium chloride-bearing hydrothermal solutions of unknown origin. The barite is more resistant to weathering than the shale (formed from the marine mud), so that the nodules now occur loose in the soil. Some barite also occurs in calcite veins cutting limestone, but these do not make interesting specimens. The chemical causing the foul odor in the barite has not been identified.

SIMILAR OCCURRENCES

Heidelberg, Mt. Aetna, and Bernville, Berks County

Barite nodule composed of coarse crystal cleavages radiating from a common center. Nodules give off a strong, obnoxious odor when broken.

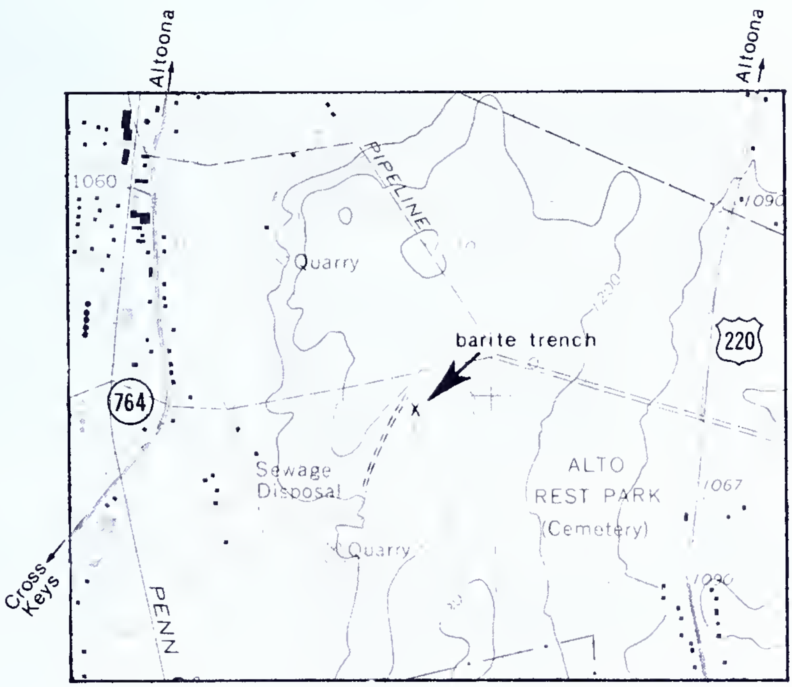
REFERENCE

Smith, R. C., II (1974), *Fetid barite from Berks County,* Pennsylvania Geology, v. 5, no. 6, p. 4-7.

ALTOONA BARITE LOCALITY

LOCATION

The Altoona barite trench is located in the Hollidaysburg quadrangle south-southwest of Altoona and between Eldorado and the Hollidaysburg State Hospital. The occurrence is between the sewage disposal plant east of Pa. Route 764 and Alto Rest Park (cemetery) on U.S. Route 220. From Pa. Route 764 turn east toward the sewage disposal plant, then bear south across the single lane bridge, past the incinerator plant, and through the chain link fence toward the dog pound. Just inside the fence bear left and park about 435 feet south of the fence. Follow the old road left, uphill to the northeast. About 800 feet from the parking area a road doubles back on the right, but continue on the same road



uphill to the northeast for another 675 feet. Here, a four-trunked tulip poplar can be seen on the left of the road. At this point walk right (east) for 125 feet to the trench up the side of a small knoll. The trench trends roughly east-west for 75 feet and is about 10 feet across and 4 feet deep. Small dumps surround the trench.

MINERALS

BARITE: white cleavages and crystals in "limonite"; some barite is zoned, most is strongly phosphorescent after exposure to ultraviolet light

GOETHITE: brown to reddish porous masses of "limonite"

GEOLOGY

The geology has been described by Way (1973), who first found the barite. Barite mineralization occurs in a breccia along a cross fault through the Silurian Tonoloway Formation. The Tonoloway is typically a thin-bedded to laminated, fine-grained limestone which often weathers in thin buff to gray plates which emit a characteristic tinkling sound when walked on. The "limonite" was probably deposited as pyrite or marcasite from the same aqueous solutions that brought in the barite. Such solutions could have been released by marine mud being lithified into shale or from brines released by tectonic destruction of oil field brines. Although the barite-"limonite" at Altoona is essentially free of lead and zinc, it may bear a genetic relationship to the lead-zinc barite occurrences in Sinking Valley, northeast of Altoona. Likewise, the "limonite" pseudomorphs after marcasite from the Eldorado quarry, 0.33 mile to the northwest, may be of a similar origin.

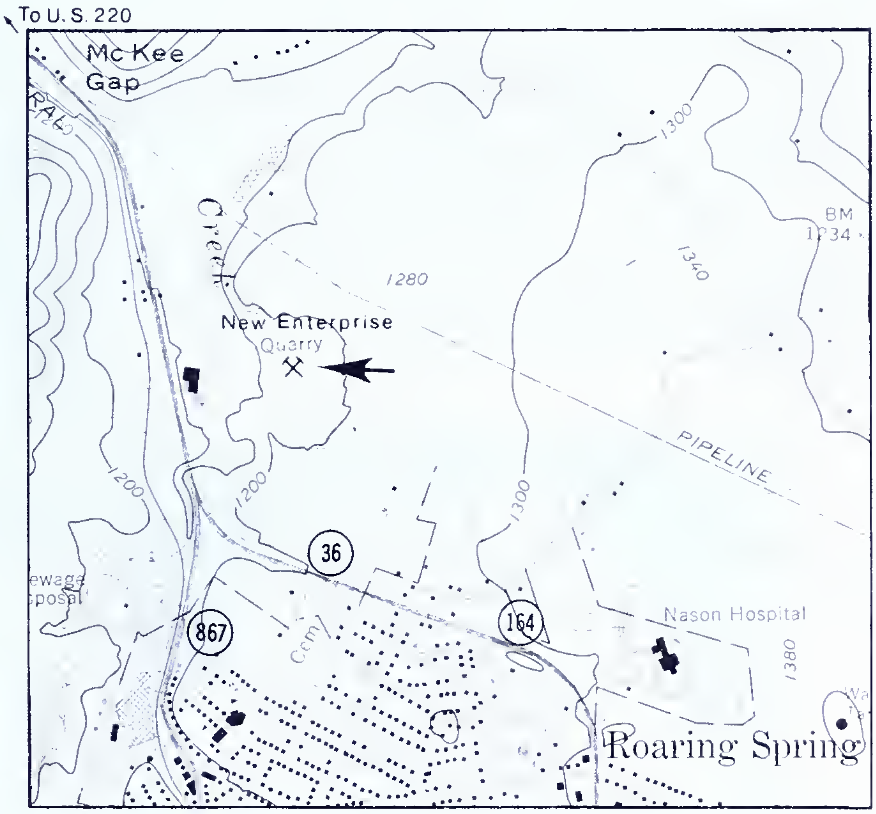
REFERENCE

Way, John H., Jr. (1973), *Barite-limonite from the Altoona-Hollidaysburg area*, Pennsylvania Geology, v. 4, no. 3, p. 4-7.

ROARING SPRING STRONTIANITE AND CALCITE LOCALITY

LOCATION

The New Enterprise Stone and Lime Company, Inc., quarry at Roaring Spring is located 0.3 mile southeast of the junction of Pa. Route 867 with combined Pa. Routes 36 and 164. This is about 0.75 mile north of the center of Roaring Spring, Taylor Township, in the Roaring Spring quadrangle. Individual permission must be obtained at the scale house. Hard hats, safety shoes, and safety glasses are required. Collecting beneath the highwalls is prohibited.



MINERALS

Apatite group: species unknown; microcrystals in metabentonite (altered volcanic ash beds)

Biotite: microcrystals in metabentonite

Calcite: good hand specimens of thin, wafer-like crystal clusters; some fluorescent with ultraviolet light

Celestine: uncommon; blue fibrous plates (extremely beautiful in transmitted light) and coarse white single crystals up to 1½ inches

DOLOMITE: white and pale-blue cleavage eyes

FLUORITE: small purple cubes

Goethite: as $^{1}/_{16}$ inch-sized "limonite" pseudomorphs after pyrite

Kaolinite group(?): in metabentonite on the northwest side of the quarry; specimens swell, then collapse to mush when washed

Pyrite: small crystals with strontianite in vugs

Quartz: as agate-like, gray and black banded chert and small crystals in vugs

Sphalerite: orange-brown blebs in silicified dolomite beds; rarely beautifully fluorescent yellow with short wave ultraviolet light

Strontianite: tufts of white, acicular crystals in vugs in limestone

Zircon: microcrystals in metabentonite

Cluster of wafer-thin calcite crystals from Roaring Spring quarry

GEOLOGY

Minerals of several different origins are present at Roaring Spring. First, are the minerals from the four or more altered volcanic ash beds in the Salona Formation. This ash was carried by wind and water from distant volcanoes during the Ordovician Period. Most of the volcanic ash minerals were converted to a clay mineral, probably kaolinite. The apatite, biotite, and zircon microcrystals are resistant minerals which have survived from the original volcanic ash.

In the slightly older Ordovician limestones of the Milroy Member of the Loysburg Formation, strontianite crystals occur in vugs with pyrite. These limestones are apparently enriched in strontium over large areas of south-central Pennsylvania. Celestine forms when these rocks are exposed to sulfate-bearing solutions or strontianite when exposed to normal ground water.

Sphalerite has been introduced into the dolomite beds of the Ordovician Bellefonte Formation via silica-rich solutions which converted a few beds into agate-like chert. An entirely different set of minerals may be found in the fossiliferous limestone of the Axemann Formation as the quarry expands northeast.

SIMILAR OCCURRENCES

New Enterprise Stone and Lime Co., Inc. quarry at Ashcom, Bedford County and Pa. Route 350 roadcut southeast of Little Juniata River, Blair County

REFERENCES

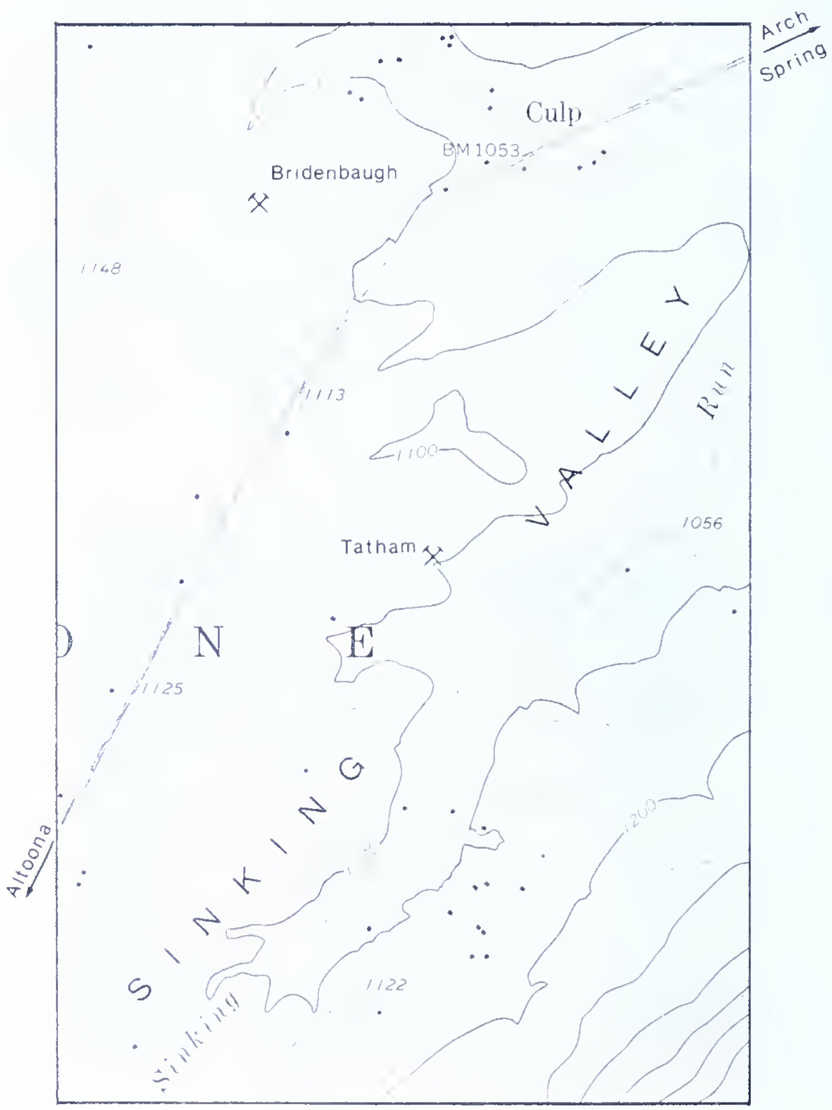
Smith, R. C., II (1974), *Zinc and lead occurrences in Bedford, Blair and Huntingdon counties*, Pa. Geol. Survey, open file 16, 80 p.

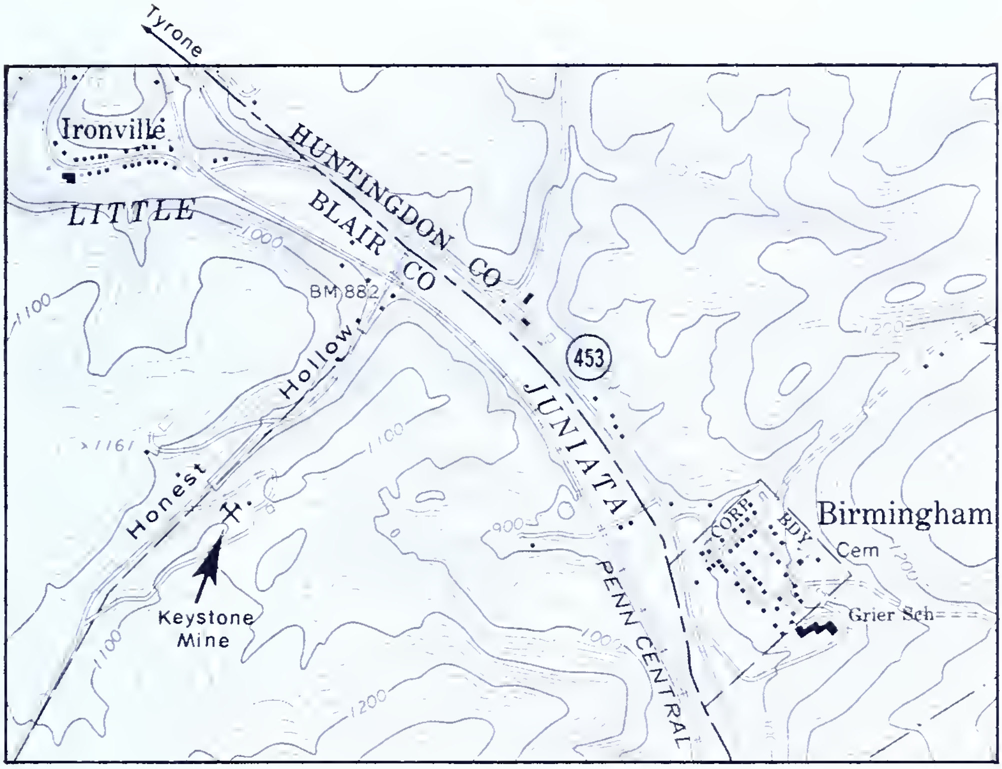
Thompson, R. R. (1963), *Lithostratigraphy of the Middle Ordovician Salona and Coburn Formations in central Pennsylvania*, Pa. Geol. Survey, 4th ser., Gen. Geology Rept. 38 (photos of metabentonite beds and minerals, p. 142-145).

SINKING VALLEY LEAD-ZINC LOCALITIES

LOCATION

Sinking Valley is located northeast of Altoona and south of Tyrone, in Tyrone Township in the Bellwood quadrangle. The Tatham prospect is located on the Ernest and Phyliss Albright farm about 1000 feet northeast of the John Tremmel residence. This area is about 1.7 miles south-southwest of the intersection at Culp. The Bridenbaugh prospect is lo-





cated on the Fred A. Good farm 0.55 mile southwest of the intersection at Culp. Because these two prospects are in cultivated fields, they may not be entered when crops are planted. However, at any time, permission of the owners is required.

The Keystone Mining Co. prospect is located on the northern edge of Sinking Valley, in Tyrone Township in the Tyrone quadrangle. This prospect is on the George Espy farm on the southeast side of Honest Hollow. The collecting area is 0.55 mile southwest of the Honest Hollow bridge over Little Juniata River. The dumps are overgrown and somewhat dangerous because of the large number of unmarked shaft openings and pits. Permission to collect is required. This area is definitely not recommended for children and the owner will eject any person who attempts to enter the dangerous underground openings.

MINERALS

ANGLESITE: gray rims on galena and microcrystals in "limonite"
BARITE: common; large masses of white cleavages, especially at the Bridenbaugh prospect
Calcite: white cleavages in veins and fracture fillings
Cerussite: small crystals in "limonite", often twinned
Dolomite: cleavages in veins
Fluorite: uncommon; purple grains in fractures through limestone; common in the road cut 1.4 miles northeast of Culp
GALENA: common; silvery, metallic with a cubic cleavage
Hemimorphite: microcrystals in "limonite"
HYDROZINCITE: common; white coatings with sphalerite; fluorescent blue with short wave ultraviolet light
Jordanite: tiny, dull gray metallic grains rimming or with galena; only from Keystone mine
Pyrite: massive; especially at the Tatham prospect
SMITHSONITE: common; dry bone ore with a cellular texture; small botryoidal crusts with gray color
SPHALERITE: common; brown to orange to yellow masses of cleavages; some fluorescent orange with ultraviolet light

GEOLOGY

Most of the zinc-lead occurrences in southern Sinking Valley are located in the transition zone between the Ordovician limestones and dolomites. Within this transition zone, mineralization is localized along nearly vertical fractures. Hydrothermal solutions of unknown origin filled these fractures with barite, sphalerite, galena, and calcite. Recent weathering altered much of the sphalerite to smithsonite and some of the galena to anglesite.

At the Keystone mine the limestone was thoroughly fractured into a rock called breccia. Mineralization was apparently more intense, and in a few cases beds of limestone were almost entirely replaced by sphalerite. Of the 15 known occurrences in Sinking Valley, this is the only place where replacement is known to have occurred.

Active mining for lead in Sinking Valley began in 1778 when General Daniel Roberdeau sought lead for bullets for the Revolutionary War. At that time, the lead was sold for the enormous sum of $6.00 per pound because of the expense of guarding the miners from hostile Indians.

REFERENCES

Platt, Franklin (1881), *The geology of Blair County*, Pa. Geol. Survey, 2nd ser., Rept. T, p. 247-277.

Reed, D. F. (1949), *Investigation of the Albright farm lead-zinc deposit, Blair County, Pa.*, U.S. Bur. Mines Rept. Inv. 4422, 7 p.

Zeller, R. A., Jr. (1949), *The structural geology and mineralization of Sinking Valley, Pa.*, unpub. M.S. thesis, University Park, Pennsylvania State University, 71 p.

NOTES

SIDERITE NODULE LOCALITIES

LOCATION

Two strip mines in northern Butler County contain siderite nodules in a zone corresponding to the 1400-foot contour line on the location map. Both localities are on the Eau Claire quadrangle.

A. The East Unity Church locality is 2 ½ miles north of the junction of Pa. Routes 38 and 58 in Eau Claire and 0.9 mile north of the main intersection in Cherry Valley. It is best reached by taking a secondary road just south of East Unity Church for 0.2 mile east from the road between the Cherry Valley intersection and the church, then traveling 0.4 mile north on a farm road. Permission to use the farm road must be obtained at the house on the south side of the secondary road.

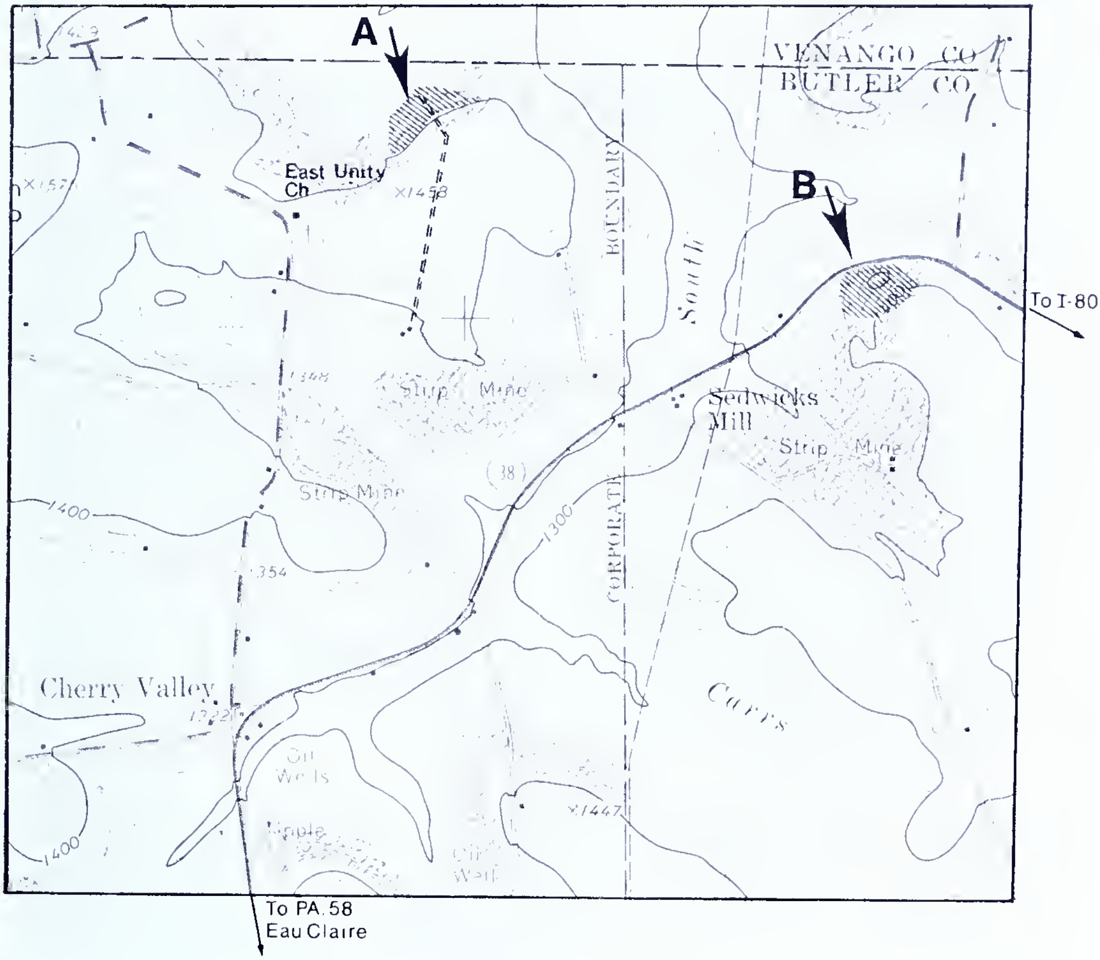
B. The Sedwicks Mill locality is 2.8 miles northeast of Eau Claire on Pa. Route 38 in Allegheny Township, 1.3 miles northeast of the Cherry Valley intersection.

MINERALS

Barite: massive; white to yellow and clear; some crystals, platy, prismatic, some distorted and doubly terminated (A and B)

Calcite: tiny acicular crystals forming spherical aggregates (B)

Chalcopyrite: small groups of intergrown tetrahedral crystals, highly iridescent blue, green and brassy (A)



Gypsum: small clusters of clear crystals (B)

Kaolinite: white to yellow clay coatings and cavity fillings (B)

Pyrite: modified cubes, octahedrons, and pyritohedrons with an iridescent coating, brassy, silvery on fresh fracture; as single crystals or drusy coatings in cavities (A and B)

SIDERITE: smooth, circular to oval, reddish-brown nodules up to four inches or larger (A and B)

Sphalerite: yellow to black, platy aggregates with hexagonal outlines; some curved aggregates of plates (A and B)

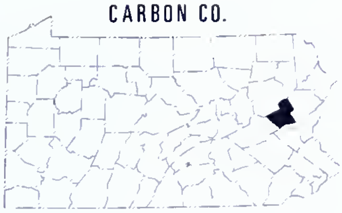
GEOLOGY

The collectable minerals of this area are present in shrinkage cracks in "clay-ironstone", or siderite, nodules found in a black shale of the Pennsylvanian Allegheny Group. The nodules probably formed under marine conditions while the mud that formed the enclosing shale was being deposited. The minerals in the nodules formed later, either while the mud was being lithified to form shale, or later through the action of ground water. Because the bedrock in this area is in nearly horizontal layers, the exposure of the bed containing the nodules can be traced on the location map at both localities by following the 1400-foot contour line.

SIMILAR OCCURRENCES

Wittmer, Allegheny County; Shelocta, Indiana County; Sugar Hill, Jefferson County; Franklin, Venango County; Donohoe, Westmoreland County.

NOTES

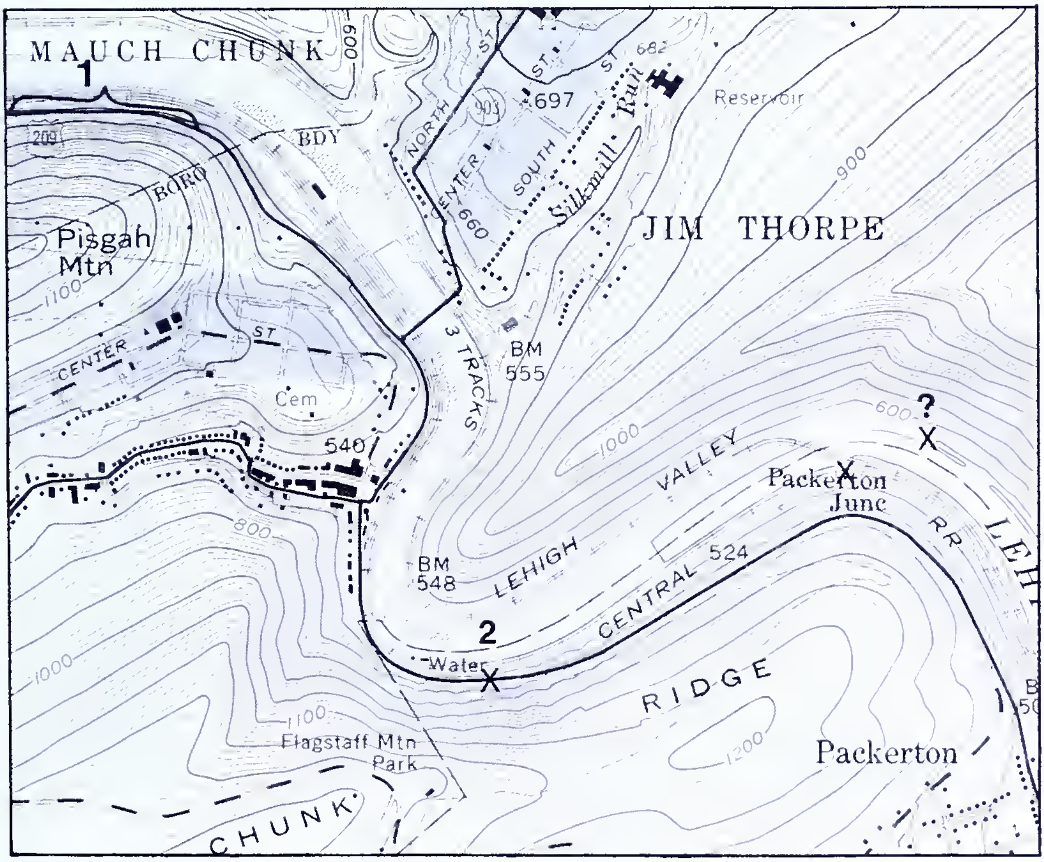


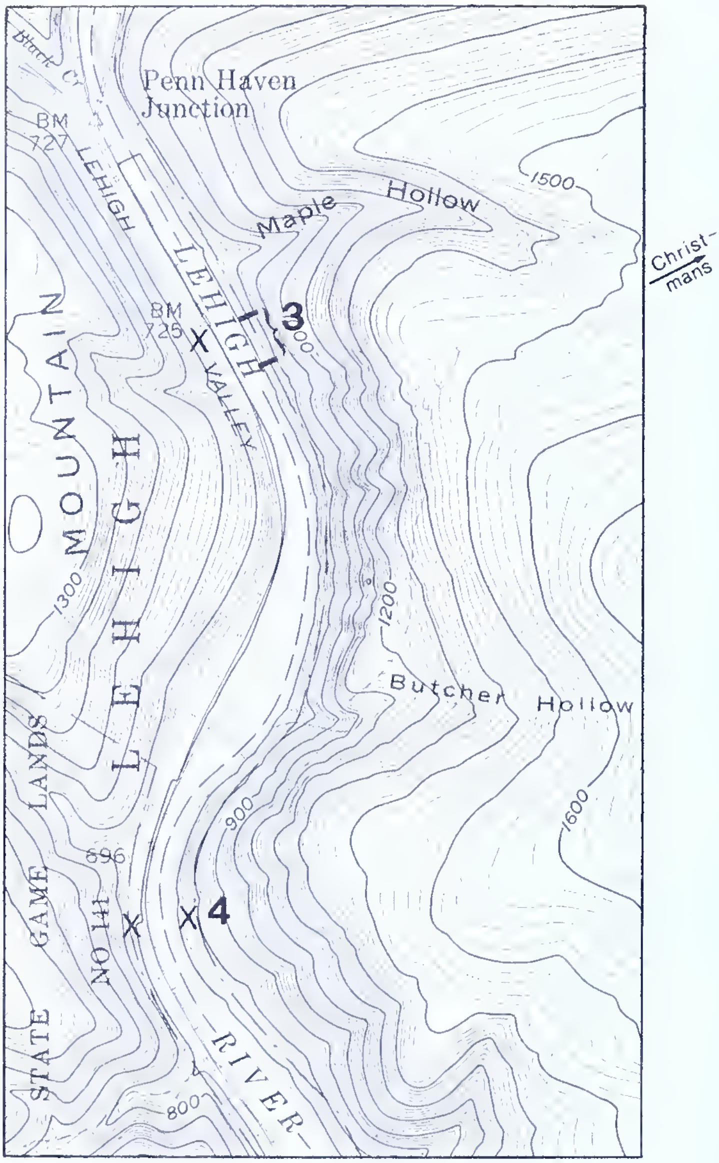
URANIUM MINERAL LOCALITIES

LOCATION

More than six uranium occurrences are known in Carbon County. Of these, four are, to varying degrees, accessible to mineral collectors.

1. The most accessible are the Pisgah Mountain occurrences along the south side of U.S. Route 209 from 2500 to 4000 feet (0.5 to 0.8 mile) northwest of the Pa. Route 903 bridge in Jim Thorpe (Lehighton quadrangle). The best collecting is between the three adits. Blue Ridge Land and Development Company owns the area and does not permit entry into the adits. Because the shoulder along the road is narrow and the cliff face is steep, collecting should be by adults only.





2. Accessible but dangerous are the occurrences on Mauch Chunk Ridge on the south side of U.S. 209 about 2000 to 3500 feet (0.4 to 0.7 mile) south-southeast of the old railroad station in Jim Thorpe (Lehighton quadrangle). Traffic is heavy and many large boulders fall off these cliffs each year. Mineralization occurs on the east side of the Lehigh River at Packerton Junction, but access is difficult.

3. Along an abandoned railroad grade 600 to 1000 feet south of Maple Hollow between State Game Lands No. 141 and the east bank of the Lehigh River (Christmans quadrangle). This is part of the so-called Penn Haven Junction occurrence. At present, access is possible only by a six- to eight-mile hike (round trip) through State Game Lands No. 141.

4. Along an abandoned railroad grade about 0.4 mile southwest of Butcher Hollow between State Game Lands No. 141 and the east bank of the Lehigh River (Christmans quadrangle). This is part of the so-called Butcher Hollow occurrence. At present, access is possible only by a long hike through State Game Lands No. 141.

MINERALS

Pisgah Mountain

- Allophane: a massive, clay mineral
- Andersonite: rare; fluoresces brilliant whitish-green with ultraviolet light
- Beta-uranophane: rare
- CALCITE: white cleavages common in the conglomerate matrix; also some coatings which fluoresce bright green under short wave ultraviolet light; possibly, the fluorescence is from associated liebigite
- CARNOTITE: common; canary-yellow coatings, especially on slickensides and quartz conglomerate pebbles; rarely in good microcrystal groups on quartz crystals
- Chlorite group: species unknown; green, in rock matrix
- Coffinite: pitchy black; resinous grains too small to see without a microscope
- Gypsum: cleavages
- Kasolite(?): apparently rare
- Liebigite: yellow-green crusts that fluoresce brilliant blue-green under short wave ultraviolet light
- Quartz: veinlets of drusy crystals along slickensides
- Schroeckingerite: minute, greenish-yellow scales; fluoresces green
- Tyuyamunite: bright, canary yellow, sometimes with a

slightly greenish cast; abundance unknown
Uranophane: pale-cream-yellow to orange coatings

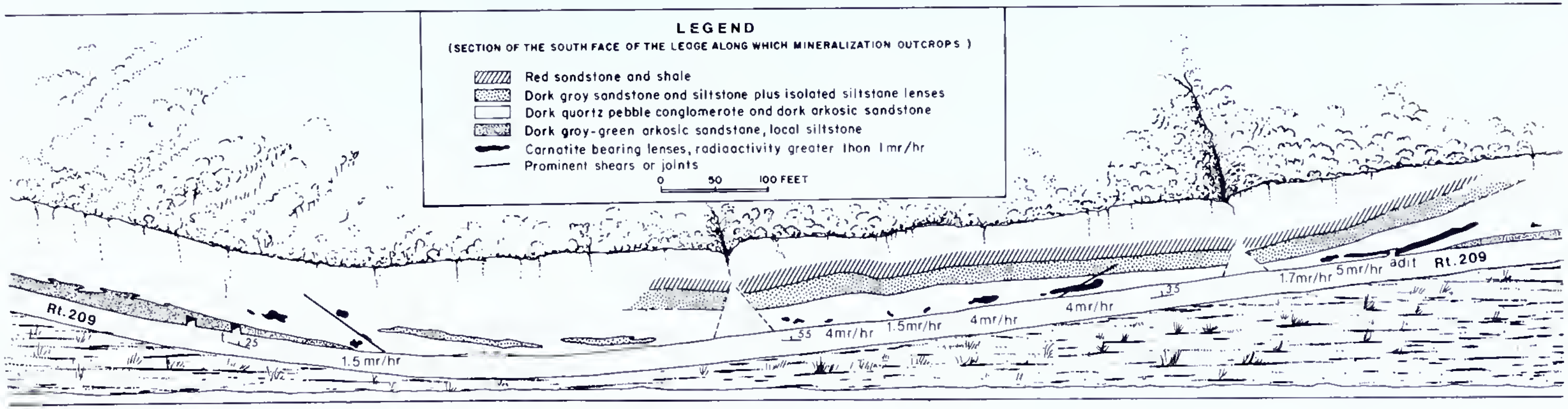
Mauch Chunk Ridge:
Billietite: yellow coatings
Meta-autunite: greenish-yellow, micaceous crusts which fluoresce brilliant green
Metatorbernite(?): uncommon
Meta-uranocircite(?): tentatively identified by X-ray diffraction
Muscovite: white flakes in graywacke matrix
Phosphuranylite: yellow coating
Uranophane: yellow coating

Penn Haven Junction:
Carnotite: common yellow coating
Chalcopyrite: rare; disseminated grains
Chlorite group: species unknown; in rock matrix and veinlets
Clausthalite: fine, galena-like disseminated particles associated with richest uraninite samples
Kasolite: rare; yellow brown
Metatorbernite: uncommon; greenish flakes
Phosphuranylite: yellow coating
Pyrite: disseminated
Sklodowskite: yellow needles between chlorite and uraninite, best seen in thin section
URANINITE: disseminated in richer samples
Uranophane

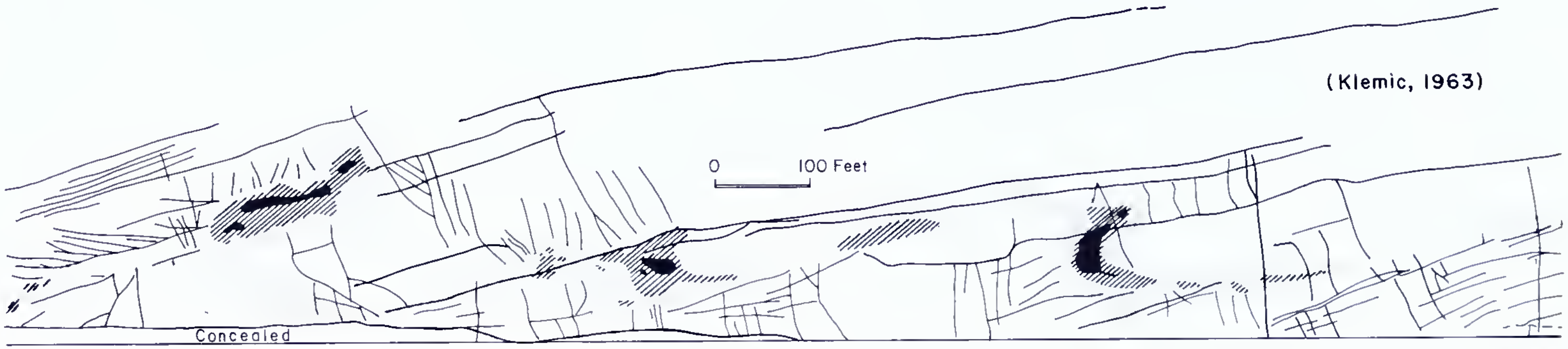
Butcher Hollow
Clausthalite: visual identification of galena-like grains
Pyrite: disseminated and as cubic crystals
Uraninite(?)

GEOLOGY

The uranium occurrences listed above are of two geologic types. The Pisgah Mountain occurrence is a type where the richest ore is concentrated in conglomerate lenses, whereas



Mt. Pisgah occurrence (McCauley, 1961)



Detailed section of roll front uranium occurrences on the Lehigh River, east side, near Penn Haven Junction. Shaded areas contain uranium minerals.

each of the other occurrences are in roll fronts (McCauley, 1961), or tabular deposits in sandstone. The primary uranium mineral in the Pisgah Mountain occurrence is coffinite which formed about 335 million years ago shortly after the sediments were deposited. At Penn Haven Junction, the primary uranium mineral is uraninite, which also formed shortly after deposition of sediments. The Pisgah Mountain occurrence is rich in vanadium, so the outcrops are coated with bright yellow carnotite where the coffinite, and perhaps other primary uranium minerals, have weathered to form secondary uranium minerals with the vanadium.

Many of the large uranium mineral occurrences in Pennsylvania are concentrated in this area. The source for the Mississippian Mauch Chunk conglomerate (Pisgah Mountain occurrence) and Devonian Catskill graywacke (all others) may have been the uranium-rich Reading Prong Province. Concentration appears to have occurred by ground waters, which were oxidizing, depositing traces of uranium in chemically reducing (oxygen free) areas over long periods of time.

REFERENCES

Dyson, J. L. (1955), *Relation of stratigraphy and structure to uranium occurrences near Mauch Chunk, Pennsylvania,* Pa. Geol. Survey, 4th ser., Inf. Circ. 5. p. 124-134.

Epstein, J. B., Sevon, W. D., and Glaeser, J. D. (1974), *Geology and mineral resources of the Lehighton and Palmerton quadrangles, Carbon and Northampton Counties, Pennsylvania,* Pa. Geol. Survey, 4th ser., Atlas 195cd, 460 p.

Klemic, Harry, Warman, J. C. and Taylor, A. R. (1963), *Geology and uranium occurrences of the northern half of the Lehighton, Pennsylvania, quadrangle and adjoining areas,* U.S. Geol. Survey Bull. 1138, 97 p.

McCauley, J. F. (1957), *Preliminary report on the sedimentary uranium occurrences in Pa.,* Pa. Geol. Survey, 4th ser., Prog. Rept. 152, 22 p.

__________ (1961), *Uranium in Pennsylvania,* Pa. Geol. Survey, 4th ser., Min. Resource Rept. 43, 75 p.

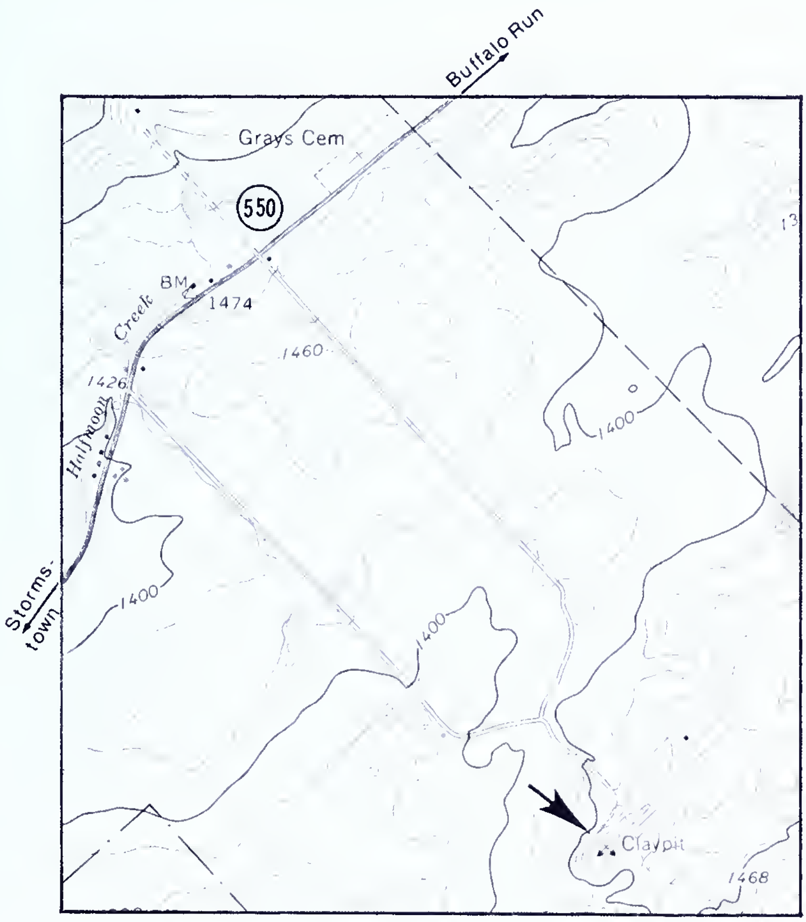
Montgomery, Arthur (1954), *Uranium minerals of the Mauch Chunk area, Pennsylvania,* Pa. Acad. Sci. Proc., v. 28, p. 102-110.

__________ (1969), *Mineralogy of Pennsylvania, 1922-1965,* Acad. Nat. Sci., Philadelphia, Spec. Pub. 9, p. 43-44.

STORMSTOWN BAUXITE LOCALITY

LOCATION

The Stormstown clay pit, 2.5 miles south of Buffalo Run on U.S. Route 322 and 1.5 miles west of the village of Marysville, is in Halfmoon Township in the Julian quadrangle. Follow Pa. Route 550 to the southwest of Buffalo Run, past Grays Church and cemetery and left (southeast) at the second unimproved road. This access road to the clay pit is private and permission to travel on it must be obtained from the owner located near the entrance. The clay pit, itself, is owned by the North American Refractories Corporation and permission to collect must be obtained from them. The best collecting is



along the northwest side of the open pit, where, however, the nodules are still not abundant.

MINERALS

Anatase: rare; microcrystals found in centers of some pisolites

GIBBSITE: as "bauxite", white to grayish nodules; mammillary; pisolitic structure; earthy

Goethite: blackish-brown to black; dull to metallic luster; forms geodes; also, as "limonite", dark brown to yellow; earthy; massive.

Hematite: earthy; red-brown

KAOLINITE: white to gray; massive, earthy, compact and sometimes plastic

Quartz: massive; milky

Rutile: rare; microcrystals found in centers of some pisolites

GEOLOGY

The nearby pits and ponds are the remains of a once flourishing iron ore mining industry. During the 1870's and 1880's many different mining companies worked these shallow, discontinuous ore pockets for Martha Furnace in Bald Eagle Valley.

The coarsely crystalline, clayey and sandy dolomite of the Cambrian Gatesburg Formation underlies this high alumina clay-nodule deposit. "Bauxite" has been formed as a residual deposit near the surface under special conditions of weathering of the bedrock. The "bauxite" nodules and clay are associated; with the "bauxite" resting on the clay and probably being an intermediate step in the continuous alteration of the Gatesburg dolomite. The structure of these "bauxite" and clay deposits is irregular masses or pockets.

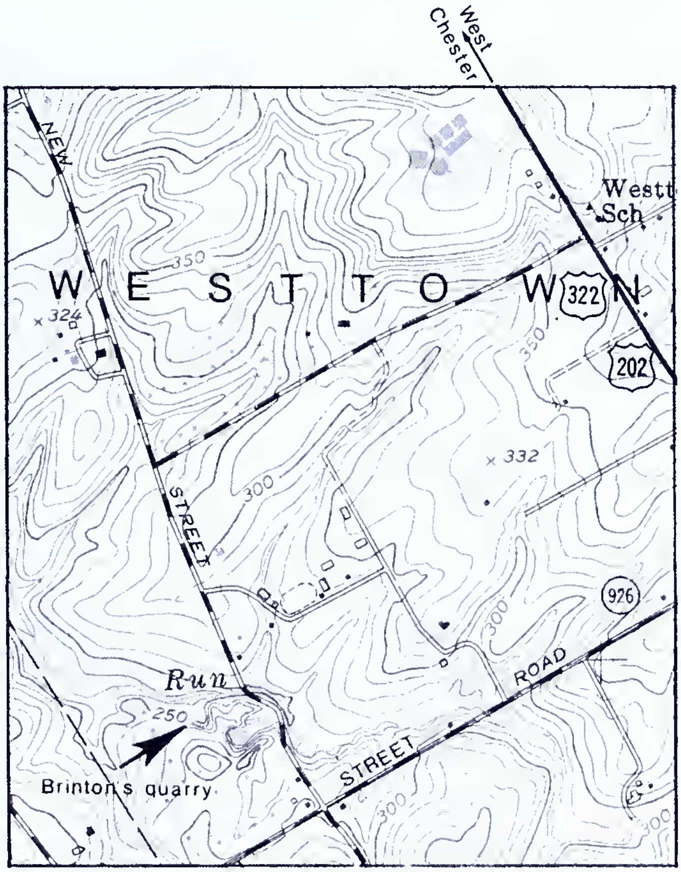
REFERENCE

Hosterman, J. W. (1973), *White clay deposits of Centre, Blair, Huntingdon, and Bedford Counties, Pennsylvania*, U.S. Geol. Survey Prof. Paper 800-B, p. B57-B65.

BRINTON'S SERPENTINE QUARRY

LOCATION

Brinton's quarry is located in the southwest rectangle of the West Chester topographic map, in Westtown Township. It is on South New Street, 0.2 mile north of Pa. Route 926 (Street Road) and approximately 2.3 miles south of the West Chester borough boundary. Three inactive quarries are at this location. Two are filled with water and inaccessible, one having been made into a private swimming pool. The third quarry is open to collectors, however, permission to enter must be obtained at Crebilly Farm, the entrance to which is on Pa. Route 926 between Darlington Corners (U.S. 202-322) and South New Street.



MINERALS

Actinolite: compact crystal needles along pegmatite contacts

Amphibole group: species unknown; asbestos-like, hard fiber

ANTIGORITE (serpentine group): very abundant; massive dull green serpentinite rock; also varieties williamsite and picrolite

Apatite group: species unknown; one green crystal reported in 1913

Aragonite: along fractures

Beryl: rare; in pegmatite

BRUCITE: moderately abundant; white, pearly cleavages; uncommonly in rosettes

Calcite(?): rosettes reported

Chlorite group: see clinochlore

CHROMITE: moderately abundant; crystals reported; some associated with thin, dendritic aggregates, might be pyrolusite

Chrysotile (serpentine group): fibrous, soft, cross-fiber serpentine veinlets in massive serpentine

Clinochlore (chlorite group): green crystals; also interleaved with vermiculite; var. sheridanite (colerainite), small cluster rosettes, rare; chromiferous variety rare

"Deweylite": tan to reddish brown and green, rarely yellow; waxy; might be mixture of clinochrysotile and stevensite

Enstatite: var. bronzite; uncommon; within massive serpentinite

Goethite: "limonite" pseudomorphs after pyrite at serpentinite-pegmatite contact

Hematite: small crystal plates

Hydromagnesite: powdery coating and rare small crystals

Ilmenite: rare; reported as massive

Kaolinite: alteration of feldspar

MAGNESITE: common; massive; white in veins with "deweylite"

MAGNETITE: massive; in serpentinite; nodules in soil

Muscovite: uncommon; in pegmatite

Oligoclase: cleavages; crystals rare

Olivine group: probably the species forsterite comprising much of the serpentinite

Pyrolusite(?): thin, dendritic aggregates associated with chromite and magnetite

Pyroxene group: see enstatite

Quartz: drusy and massive on fractures

Schorl (tourmaline group): rare; in pegmatite

Sepiolite(?): needs verification

Serpentine group: see antigorite; chrysotile

TALC: massive and small flakes; pale green to white

Tourmaline group: see schorl

Tremolite: uncommon; associated with actinolite

Vermiculite group: species unknown; brown crystal prisms; cleavage flakes very abundant; at serpentinite-pegmatite contacts; variety "jefferisite"

GEOLOGY

The geologic history leading to the formation of these minerals involves several stages, beginning in the early Paleozoic Era with the intrusion of magma from considerable depth. The magma solidified to form a rock that was very low in silica and contained abundant forsterite (olivine group) and enstatite. The forsterite and enstatite in the massive serpentinite are remnants of this intrusive rock. After the intrusive rock cooled, it hydrated to form the serpentinite. Following the formation of the serpentine minerals, the area was intruded again, this time by hot, watery, silica-rich solutions, probably from a shallower depth. It is this second intrusion that is responsible for most of the collectable minerals, forming directly from the solutions, and by chemical reactions between the solutions and the serpentine. Many small veinlets can be seen cutting the serpentinite on the east wall of the quarry. These veinlets commonly contain brucite, talc and tremolite near the contact with the serpentinite, and vermiculite in the center. A wider pegmatite dike on the south wall contains the same minerals, plus feldspar and other minerals in the center. The final stage is weathering, which has resulted in many secondary minerals, such as hydromagnesite.

SIMILAR OCCURRENCE

Cedar Hill quarry

REFERENCES

Gordon, S. G. (1922), *The Mineralogy of Pennsylvania,* Acad. Nat. Sci., Philadelphia, Spec. Pub. 1, 255 p.

Jefferis, W. W. (1854), *Mineralogy of Chester County with the localities annexed,* Friends of Mineralogy, Region 3, Pennsylvania, Special Reprint No. 2, 1974, 55 p.

Larsen, E. S. (1928), *A hydrothermal origin of corundum and albitite bodies,* Econ. Geology, v. 23, p. 398-443.

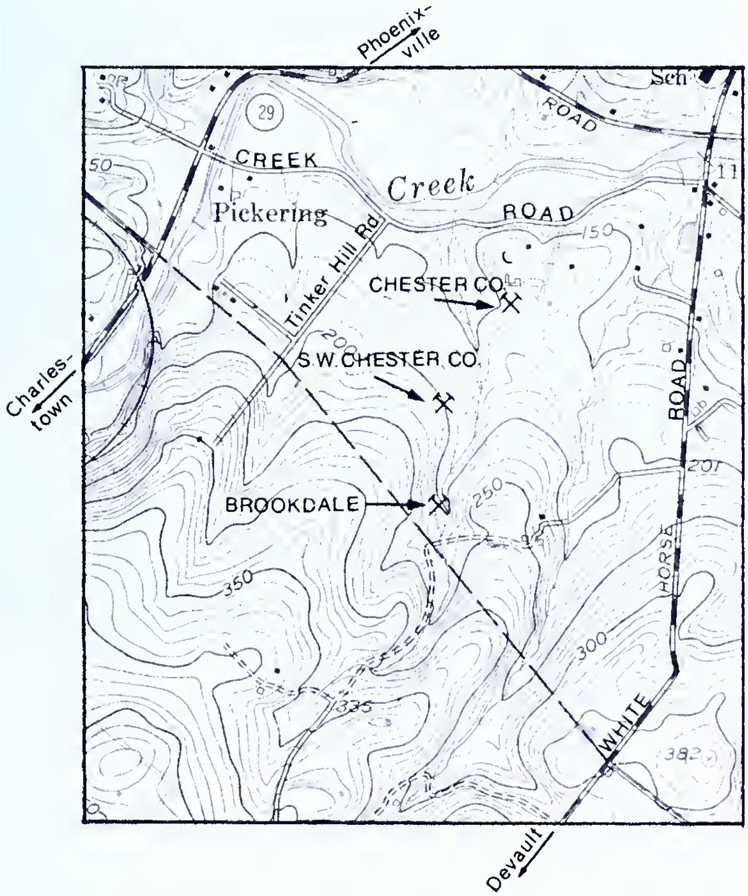
McKinstry, H. E. (1916), *The minerals of Brinton's quarry, Chester County, Pennsylvania,* Am. Mineralogist, v. 1, p. 57-62.

NOTES

BROOKDALE AND CHESTER COUNTY MINES OF THE PHOENIXVILLE LEAD-ZINC DISTRICT

LOCATION

The Chester County and Brookdale mines are located between White Horse Road and Pa. Route 29, south of Pickering Creek. This area is 1.5 miles south of the center of Phoenixville on the Malvern quadrangle. The Brookdale mine and southwest end of the Chester County mine are on the G. Thompson dairy farm. This farm can be entered from White Horse Road, 0.5 mile south of Williams Corner. The Brookdale mine collecting area is reached via a trail west from the Thompson farm. Dumps occur near the old stack and in the gulley to the southeast. The southwest end of the Chester

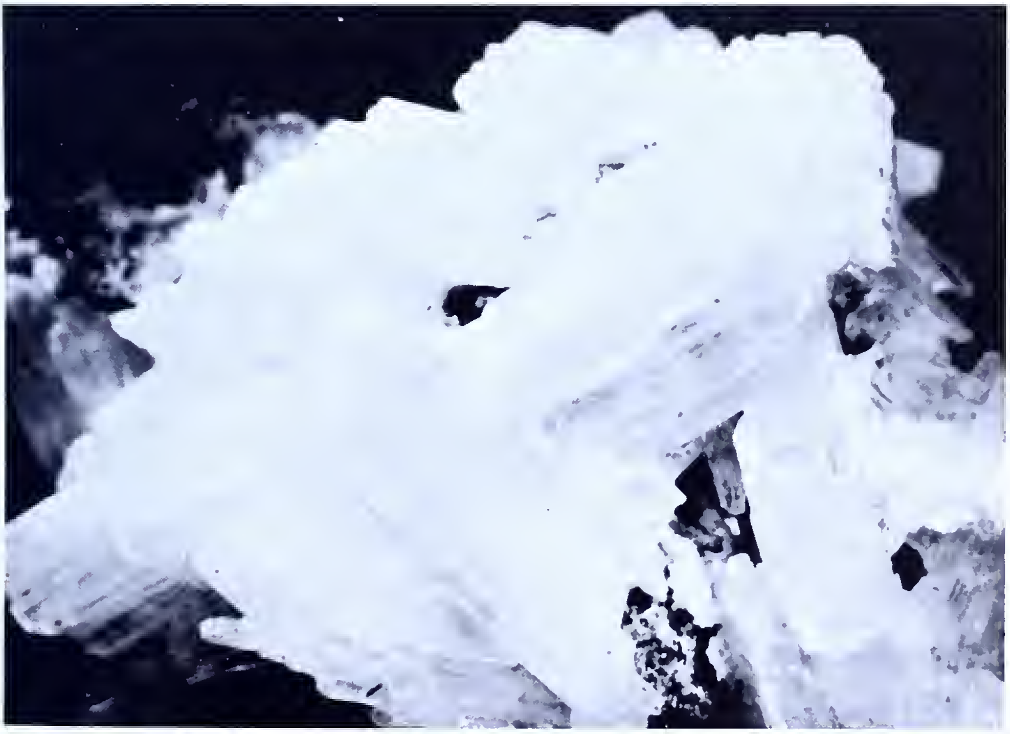


County mine is in an overgrown pasture 0.25 mile north-northwest of the same stack. The Chester County mine dumps are located behind the barn for the Pickering Hunt Club, 0.4 mile southwest of Williams Corner. Both the hunt club and dairy farm require collectors to obtain permission. All holes must be promptly backfilled. As it has been in the past, collecting is strictly forbidden at the Wheatley mine.

MINERALS

Anglesite: good, gray crystals on galena or quartz
Aragonite: tufts of small crystals
Azurite: rare
Barite: masses of white cleavages
Bornite(?): reported
Calcite: cleavages
Cerussite: good, small crystals
Chalcocite(?): reported
Chalcopyrite: massive; in quartz
Chlorite group: species unknown; small, greenish balls on quartz
Copper: rare; wires
Cuprite: rare
Descloizite: rare; reddish; mammilary with pyromorphite
DOLOMITE: tan colored; ferroan variety; in veins
Fluorite: rare; colorless crystals
GALENA: massive cleavages, often with anglesite or cerussite; tiny blebs in clear quartz crystals
Gersdorffite(?): reported but doubtful
Goethite: with "limonite"
Hematite: specular, micaceous
Hemimorphite: uncommon microcrystals
Linarite(?): medium-blue crystals with cerussite
Malachite: small silky crystal tufts
Mimetite: rare; tan hexagonal prisms and yellow tufts

Pyrite: massive
PYROMORPHITE: small, green hexagonal prisms coating quartz
QUARTZ: milky quartz clusters with single crystals up to 3 inches
Silver: wires; extremely rare
SPHALERITE: golden-brown cleavages up to 3 inches; uncommon as crystals on quartz
Sulfur: rare; minute yellow crystals
Vanadinite: uncommon; brown hexagonal prisms
Wülfenite: red-orange, tabular microcrystals on pyromorphite



Mass of cerussite crystals from the Phoenixville district

GEOLOGY

Most of these mines were operated for lead and zinc during the middle 1800's. The southwest end of the Chester County mine, however, was operated about 1920. During the earlier period, the Wheatley, Chester County, Brookdale, and Phoenix mines all operated on the same vein system and together were an important source of lead and zinc. The veins consisted of sphalerite and galena in quartz at depth, but near the surface the galena was altered to secondary lead minerals such as anglesite, cerussite, and pyromorphite. At times, pyromorphite was an important ore mineral and literally tons of crystals were smelted to recover the lead. Most of the sphalerite near the surface simply dissolved. Thus, secondary zinc minerals are uncommon despite the fact that the veins originally contained more sphalerite (zinc) than galena (lead).

Most of the veins are steeply dipping to vertical and vary from a few inches to a few feet across. This made mining expensive and relatively unprofitable. Here, the veins cut Precambrian granitic gneiss, but similar veins at Audubon cut Triassic red beds. Thus, both sets of veins are probably Triassic or younger.

SIMILAR OCCURRENCES

New Galena, Bucks County; Perkiomen and Ecton mines at Audubon, Montgomery County; Charleston, Jug Hollow, Montgomery, Pennypacker, Phoenix, and Wheatley mines in Chester County.

REFERENCE

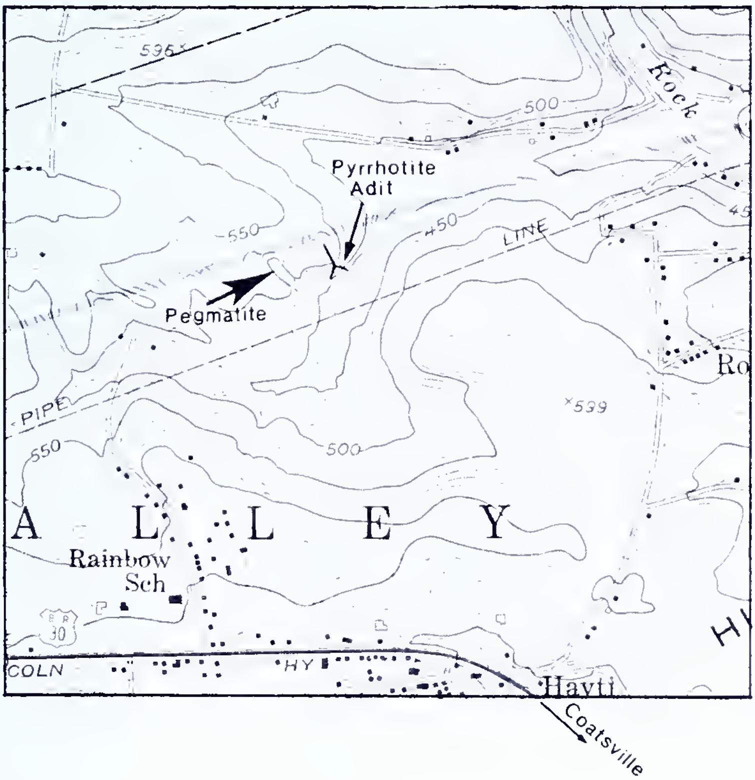
Rogers, H. D. (1858), *Geology of Pennsylvania*, Pa. Geol. Survey, 1st ser., v. II

COATESVILLE PEGMATITE AND PYRRHOTITE LOCALITIES

LOCATION

The pegmatite is located 1.5 miles northwest of the center of Coatesville and just south of U.S. Route 30 in Valley Township in the Coatesville quadrangle. Because parking is not permitted along U.S. Route 30, one should park along a north-south secondary road 0.3 mile southwest of the pegmatite and 0.7 mile north of Business U.S. Route 30.

The pyrrhotite adit and dumps are located 150 feet northwest of a tributary to Rock Run, 300 feet south of U.S. Route 30, and 0.9 mile west-northwest of Rock Run Village. The adit is on the southeast side of a hill at an elevation of about 500 feet. The adit is unsafe but the dumps toward the creek contain interesting minerals.



View of Coatesville pegmatite quarry, east side

MINERALS

Pegmatite:

- Almandine(?) (garnet group): from gabbro boulders
- Beryl: small yellow to green hexagonal crystals
- BIOTITE: black books commonly 1 to 3 inches
- Dumortierite: rare; bluish-purple, fibrous crystals with schorl from a thin vein through gabbro boulders between the quarry and adit
- Epidote: small, light-green crystals in pegmatite and in heavy sands from creek
- Garnet group: see almandine and spessartine
- Kaolinite: pure white powder from altered microcline
- MICROCLINE: coarse, crude crystals intergrown with quartz
- MUSCOVITE: books up to 4 inches, especially on the east and southeast sides

QUARTZ: clear and smokey, the latter sometimes gemmy in small areas
Schorl (tourmaline group): black crystals
Spessartine (garnet group)(?): from the pegmatite margins
Tourmaline group: see schorl
VERMICULITE GROUP(?): species unknown; brownish, somewhat pearly flakes altered from biotite or chlorite

Muscovite crystal with hexagonal outline in pegmatite from the Coatesville quarry

Pyrrhotite adit and dumps:
Chalcopyrite: tiny grains in pyrrhotite; the tarnished pyrrhotite is easily mistaken for chalcopyrite and even bornite
Dolomite: ferroan variety; tan, sharp cleavages up to ¼″ in pyrrhotite; some could be true ankerite
Dravite (tourmaline group): golden-brown prisms

Goethite: "limonite"; brown rusty coating on pyrrhotite
Graphite: trace; black flakes
Melanterite(?): white powder on weathered pyrrhotite
PYRITE: massive and cubes up to 1 inch in pyrrhotite
PYRRHOTITE: monoclinic; massive pieces up to a few feet across

GEOLOGY

The pegmatite is an intrusive rock which invaded various Precambrian gneisses and metagabbros. The pegmatite is pod shaped and the pod exhibits only a crude zoning of minerals. The central core contains feldspar and quartz. Beryl is reported to be concentrated nearer the margins.

The pyrrhotite adit is located in a mica schist of metamorphic origin. Other deposits of this type contain copper and zinc. Similar occurrences at Ducktown, Tennessee, are believed by some to have formed where volcanic exhalations brought sulfur and base metals into mud on the sea floor; heat and pressure then metamorphosed the mud into a sulfide-rich schist.

REFERENCES

Bascom, Florence and Stose, G. W. (1932), *Coatesville-West Chester, Pennsylvania-Delaware,* U.S. Geol. Survey Geologic Atlas Folio 223, 15 p.

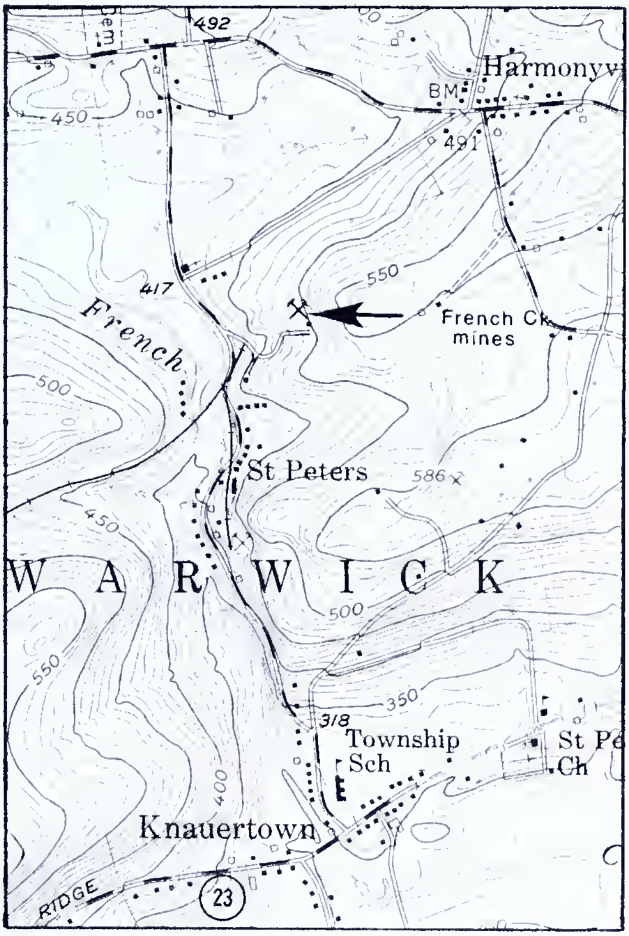
Montgomery, Arthur (1969), *Mineralogy of Pennsylvania, 1922-1965,* Acad. Nat. Sci., Philadelphia, Spec. Pub. 9, p. 43-44.

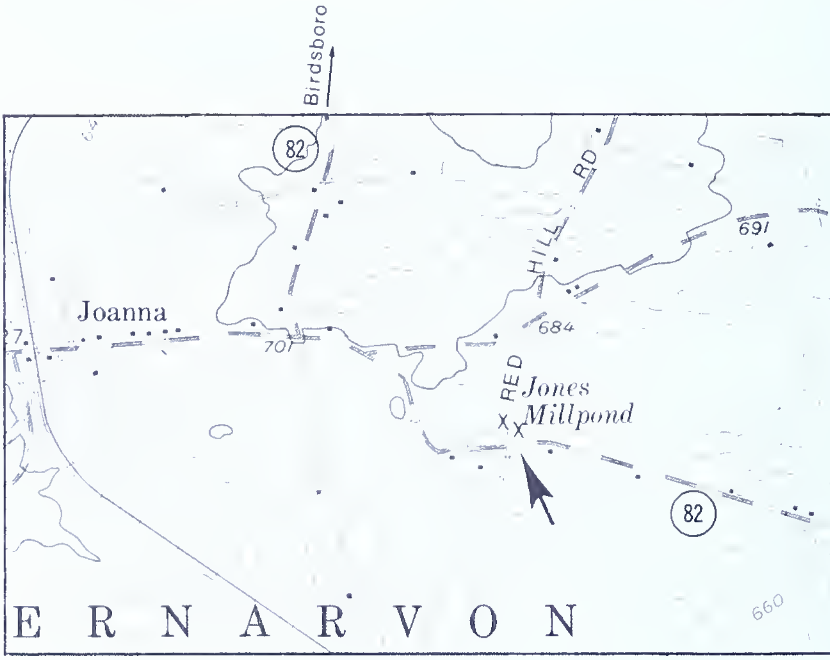
Stose, R. W. and Hughes, H. H. (1931), *Feldspar in Pennsylvania,* Pa. Geol. Survey, 4th ser., Min. Resource Rept. 13, 60 p.

FRENCH CREEK AND JONES MAGNETITE-CHALCOPYRITE MINES

LOCATION

The French Creek mines and dumps are located in Warwick Township (Pottstown quadrangle) approximately 0.7 mile north of the village of Knauertown on Pa. Route 23. The community of St. Peters, about 0.14 mile south of the collecting site, has been restored to reflect its appearance in earlier days. The entrance to the collecting site is a gravel road along the east side of the highway. The property is owned by Peter S. Chonka and a sign just off the main road tells collectors to proceed to his house at the top of the hill for permission and payment of a daily fee. The best collecting is also at the top of this hill about 50 yards north of his house.





About 6.5 miles to the west is the Jones (Berks County Warwick) Mine about 0.75 mile east of Joanna. On the Elverson quadrangle in Caernarvon Township of Berks County, this locality is marked by a small lake named "Jones Millpond." Collecting is excellent from the dump adjacent to the lake along Red Hill Road about 150 feet north of the intersection of Elverson Road and Red Hill Road. Another dump is directly across Red Hill Road. This location is private property and permission to collect must be obtained.

This area has an interesting history. By the late 1700's, this area of Pennsylvania had become the center of the nation's ironmaking industry. Nearby, the Warwick mine and the Hopewell mine supplied ore to Hopewell Furnace, preserved only a few miles west of St. Peters. The restored stone buildings and the reconstructed wooden ones, in addition to the Hopewell Furnace itself, present an authentic picture of the social, cultural, economic, and industrial life in an ironmaking community of early America. The Hopewell Village National Historic Site is administered by the National Park Service.

Iron ore was discovered at the French Creek property in 1845. Two open pits were worked initially but by 1877 mining was being done on a large scale in two mine shafts. In 1926, the ore was about mined-out and the mines were closed for the last time in 1928. It has been estimated that a total of one million tons of ore was taken from the French Creek deposit. A final chapter was written when the original E. & G. Brooke Iron Company sold the property of 22 acres to Peter Chonka who now has made the stone office building his residence.

In 1874 Charles M. Wheatley owned the Jones mine as well as the Wheatley mine in Chester County. At that time copper and iron were being mined from the Jones property. Charles Wheatley and Benjamin Silliman (the famous mineralogist) formed a company known as the Chemical Copper Company to process the ore from the Jones mine. Although initial assays showed the ore containing 5% copper, it proved to produce only 2% and this, coupled with a depression which reduced the price of copper from 25¢ to 12¢ a pound, made its extraction unprofitable. However, the Chemical Copper Company brought in western ore and developed the electrolytic refining of copper and became the first company in the United States to do it profitably. By 1880, beset with problems and plant accidents, Wheatley went bankrupt and the company came to an end.

MINERALS

French Creek mines:

ACTINOLITE (amphibole group): var. byssolite; as fibrous mats; also needle inclusions in calcite

Amphibole group: see actinolite, anthophyllite, hornblende

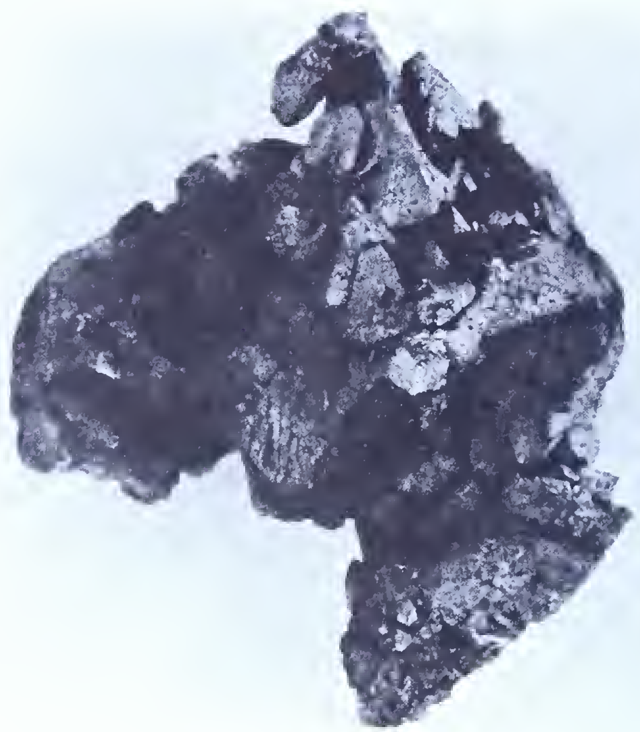
Andradite (garnet group): small crystals

Anthophyllite (amphibole group): fibrous

Apophyllite (amphibole group): white crystals

Aragonite: small crystals

Augite: rare; associated with hornblende
Azurite: rare; generally as a blue coating
Biotite
CALCITE: white, green to nearly black crystals and cleavages, sometimes pinkish from oxidized iron
CHALCOPYRITE: crystals; tetrahedrons up to ½ inch



Mass of chalcopyrite tetrahedrons from French Creek

Chlorite group: species unknown; crystal flakes
Chrysocolla: rare; probably a hydrous copper silicate mixture
Cobaltite: silver-gray with erythrite
Datolite: small, glassy, white crystals with feldspar, apophyllite, and stilpnomelane
Diopside (pyroxene group): small, greenish "melted" crystals in marble

Epidote: massive; crystals rare
Erythrite: rare; pinkish-lilac coatings
Garnet group: see andradite, grossular
Graphite: flakes in marble
Grossular (garnet group): small crystals
Gypsum: var. selenite; rare; small, clear cleavages and single-crystal groups
Hematite: plates, frequently in calcite
Heulandite: rare; crystals
Hornblende (amphibole group): black blades
Ilmenite: black with good cleavage; in diabase
Jarosite: yellow-brown coating with gypsum
MAGNETITE: platy, octahedral crystals and massive; one of the most interesting and abundant minerals

Collecting on the French Creek dumps

Malachite: coatings associated with chalcopyrite
Microcline: pink
Orthoclase: massive; flesh-colored
PYRITE: octahedral crystals and cubes

Pyroxene group: see diopside
Pyrrhotite: rare; usually massive
Quartz: massive and small crystals
Scapolite group: rare; species unknown
Schorl (tourmaline group): rare
Siderite(?): rare; reported
Sphalerite: rare; small, dark-brown crystals
Stilbite: rare; crystal sheaves
STILPNOMELANE (chalcodot): small brassy-brown flakes in cavities with byssolite and feldspar
Talc: flaky to massive
Thomsonite: rare
Tourmaline group: see schorl
Zoisite(?): may be clinozoisite

Jones Mine:
Apatite group: species unknown; white, long ½ inch, slender hexagonal prisms
Aragonite: needles in vugs
BROCHANTITE(?): thin, emerald-green coatings on magnetite and chalcopyrite
CHALCOPYRITE: tetrahedral crystals
CHLORITE GROUP: species unknown
DOLOMITE: ferroan; white cleavages
MAGNETITE: tetrahedrons and octahedrons
Malachite: green coatings
PYRITE
Serpentine group: species unknown
SIDERITE(?): white to tan cleavages

GEOLOGY

In the vicinity of the French Creek mines, the Precambrian biotite gneiss with marble lenses formed a basement on which the Triassic sandstones and shales were deposited and through which diabase was intruded. The magma that formed the diabase, in the area of the mines, was intruded parallel to the banding of the gneiss. The marble (the Franklin Formation of Precambrian age) is very coarsely crystalline, white in color, and contains scattered flakes of graphite and diopside. The magnetite ore body is the result of replacement of these lens-shaped bodies of marble by iron-rich solutions originating from the diabase intrusion. The ore deposit formed about the same time as the cooling and solidification of the diabase. The ore and sulfide minerals are found both as massive lenses or pods and scattered throughout the marble. The other minerals which are not ores are termed gangue (or accessory) minerals. These are generally on the edges of the massive ore and continue for quite a distance away from the ore into the marble.

The Jones Mine ore body formed by the replacement of Paleozoic dolomite above a northward dipping Triassic diabase sheet. Presumably, the diabase intrusion furnished the hydrothermal solutions which replaced the dolomite. The ore body is overlain by Paleozoic shale and Triassic-age sedimentary rock. The mine is believed to have produced about 500,000 tons of magnetite ore as well as several thousand tons of 6-7% copper ore between 1870 and 1875.

SIMILAR OCCURRENCES

Warwick and Hopewell mines in this vicinity; also Cornwall in Lebanon County; Morgantown and the Wheatfield mines both in Berks County.

REFERENCES

Bascom, Florence and Stose, G. W. (1938), *Geology and mineral deposits of the Honeybrook and Phoenixville quadrangles, Pennsylvania,* U.S. Geol. Survey Bull. 891, 145 p.

Evans, F. H. (1963), *The history of the French Creek Mines, Chester County, Pennsylvania,* Rocks and Minerals Magazine, Jan.-Feb.

Fergusson, W. B. (1970), *Story of the rocks, French Creek State Park,* Pa. Geol. Survey, 4th ser., Park Guide 6.

Montgomery, S. P. (1963), *Actinolite (byssolite) and stilpnomelane from French Creek Mines, Pennsylvania,* unpub. M.S. thesis, Bryn Mawr, Bryn Mawr Coll.

Smith, L. L. (1931), *Magnetite deposits of French Creek, Pennsylvania,* Pa. Geol. Survey, 4th ser., Min. Resource Rept. 14, 52 p.

Spencer, A. C. (1908), *Magnetite deposits of the Cornwall type in Pennsylvania,* U.S. Geol. Survey Bull. 359, p. 65-69.

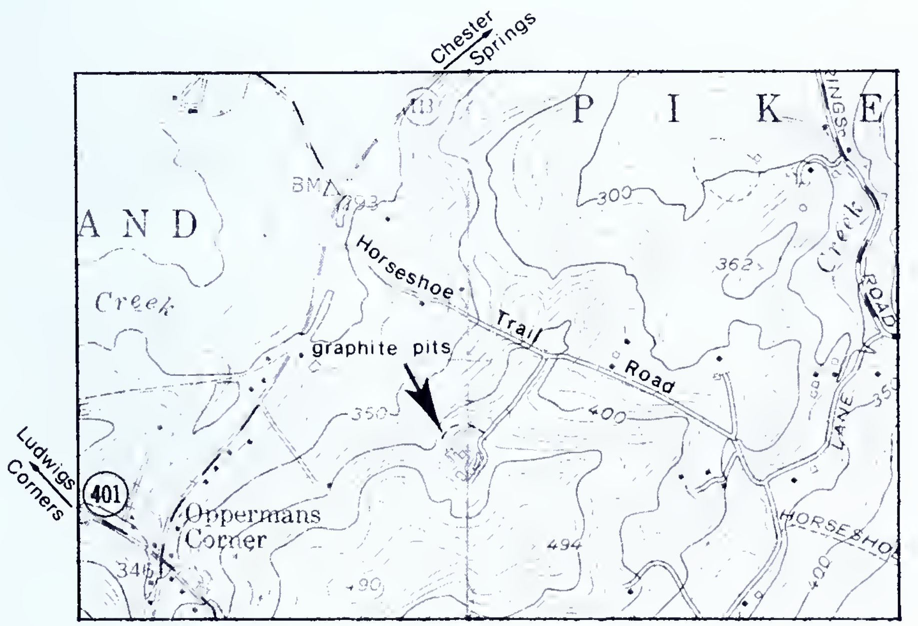
French Creek Number 2 mine with wood-burning locomotive — 1881

French Creek Number 2 mine and miners — 1881

GRAPHITE LOCALITY

LOCATION

The graphite pits and quarries, at one time operated by the Graphite Corporation of America and also the site of the old Ben Franklin mine, are located about 1.1 miles southwest of the village of Chester Springs. This locality is in West Pikeland Township in the Downingtown quadrangle and adjoining Malvern quadrangle between Route 113 and the Horseshoe Trail Road. The ruins of the buildings and mill complex are at the end of a one-quarter mile unimproved road. There is a small dirt road to the right before the complex gate that leads to the pits and quarries to the northwest of the buildings. Ask permission from the owners before collecting.



MINERALS

Biotite (mica group): flakes in schist
Garnet group: species unknown; small crystals
Goethite: "limonite" coatings
GRAPHITE: foliated; massive and flake
Hornblende: reported in nearby gneiss
Mica group: see biotite
Pyrite: small cubes weathering to "limonite"
Quartz: blue; some white; massive
Zircon: uncommon; small crystals in schist

GEOLOGY

The graphite occurs in several different geological associations. The majority is present as foliae and flakes in a rather compact quartz-mica schist. Graphite is aligned along schistosity planes and abundant in quartz veins resulting in local concentrations of a high grade. Two less important modes of occurrence are as flakes along cleavage planes of feldspar and along schistosity planes in a Precambrian biotite-hornblende-feldspar rock. The graphite concentration owes its origin, at least in part, to the metamorphism that altered a previous sedimentary rock rich in carbonaceous material.

REFERENCES

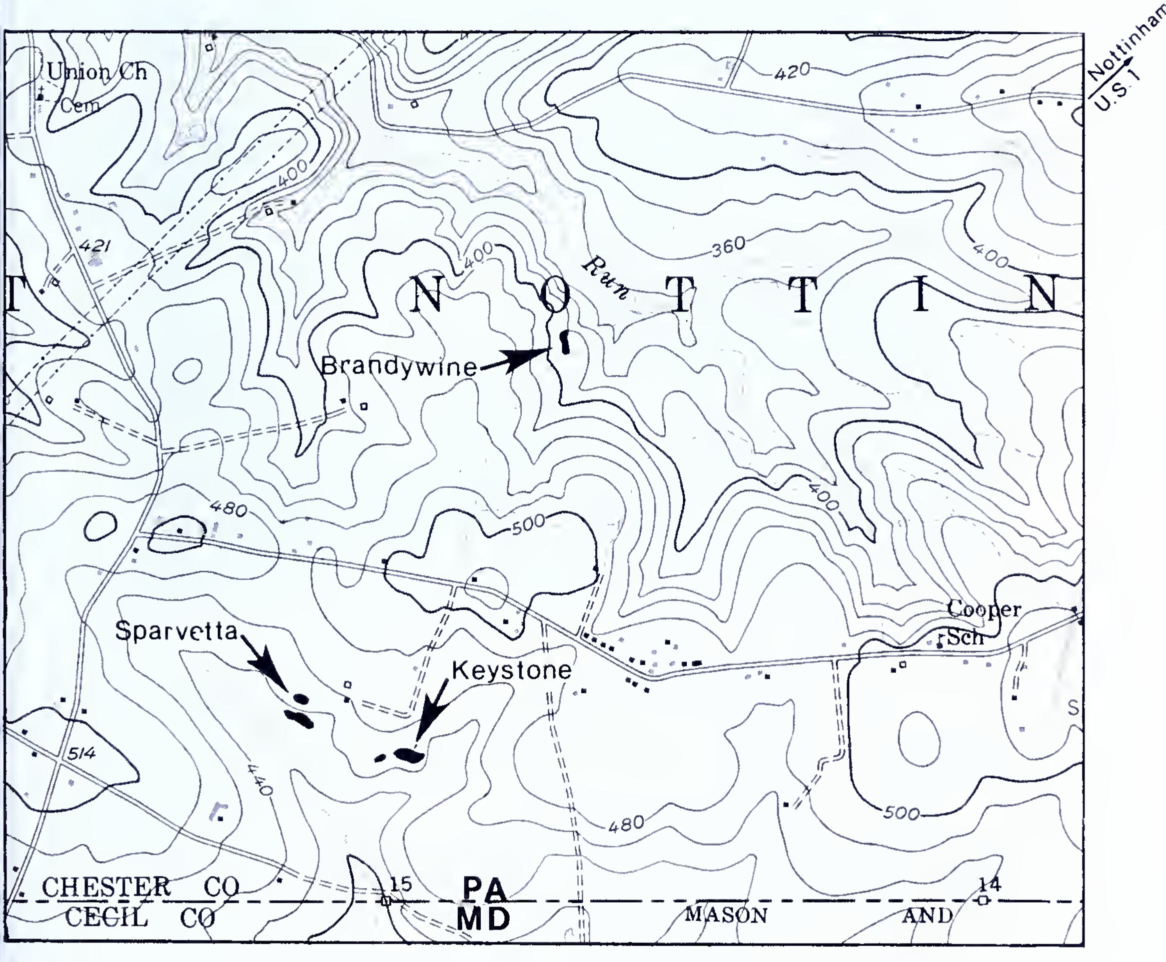
Miller, B. L. (1912), *Graphite deposits of Pennsylvania,* Pa. Geol. Survey, 3rd ser., Economic Rept. 6, p. 67-82, 96-110.

Sanford, R. S. and Lamb, F. D. (1949), *Investigation of the Benjamin Franklin graphite mine (Government owned) and the Just graphite mine Chester County, Pennsylvania,* U.S. Bur. Mines Rept. Inv. 4530, 17 p.

STATE LINE DISTRICT FELDSPAR QUARRIES

LOCATION

In an area known as "the Barrens", a group of feldspar deposits were worked from the turn of the century to the 1930's. The largest of these deposits were quarried and became known as the Sparvetta, Keystone, and Brandywine quarries. All are located in the Rising Sun quadrangle, about 2.5 miles southwest of Nottingham in West Nottingham Township. The operations have been abandoned many years and are now filled with water. They appear as small lakes on the topographic map.



The Sparvetta and Keystone quarries are on private property and permission to enter them must be obtained from Mrs. Greta Burke who lives at the end of the lane. The mine dumps and quarries lie in a very picturesque farm setting highlighted by the ruins of a large feldspar-processing mill that was located beside the Sparvetta deposit. The gigantic mill stones, the building foundations, and some tools and machinery remain.

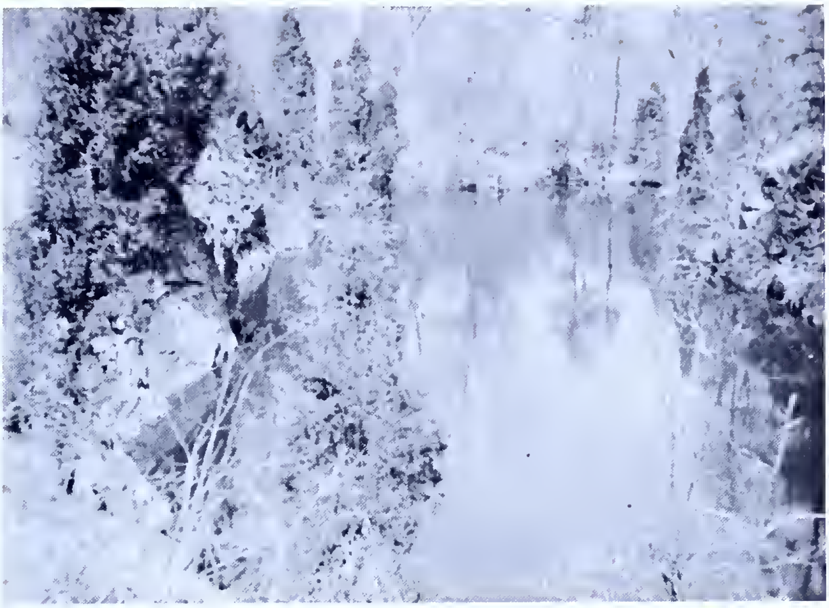
The Brandywine deposit as well as many smaller unnamed deposits are now within Nottingham Park, one of the parks operated by the Chester County Recreation Board. No minerals may be removed from the park area; the quarry has been preserved and the history and geology may be reviewed.

Old mill stones from ruins of Sparvetta Mill adjacent to the quarry

MINERALS

Actinolite: compact fibers

ALBITE (feldspar group): cleavages with rare moonstone; translucent



Brandywine feldspar quarry — 1975

Antigorite (serpentine group): the majority of the massive serpentinite rock; also the varieties williamsite and chrome-antigorite; fine fibers from the Nottingham Park area

Apatite group: species unknown; crystals uncommon

Aragonite: small crystals fluoresce white to pink in ultraviolet light

Chlorite group: in flakes; probably clinochlore and var. sheridanite (colerainite) as small cluster rosettes on feldspar; see also kämmererite

Chlorite-vermiculite groups: species unknown; flakes which are interlayered brownish green to brown

Chromite: grains in serpentinite; veins and massive from the northern part of the Nottingham Park area

Chrysotile (serpentine group): fibers in small veinlets

"DEWEYLITE": tan, brown, gray, waxy and brittle; fluoresces in ultraviolet light

Dolomite: tan colored; fluoresces in ultraviolet light

Feldspar group: see albite, orthoclase

Sparvetta feldspar quarry — 1975

Goethite: reniform in feldspar; up to 6-8 inch masses; especially in fields north of Cooper School
Hematite: massive and secondary coatings
Kämmererite (chlorite group): pink to rose-violet on chromite; found mainly in the Nottingham Park area
Magnetite: small octahedrons in serpentinite and chlorite schist
Molybdenite: rare; blue-gray flakes
Muscovite: crystal flakes associated with pegmatite
ORTHOCLASE (feldspar group): massive, cleavages, rarely in crystals
Quartz: usually massive with orthoclase or albite
Schorl (tourmaline group): very rare
Serpentine group: see antigorite, chrysotile
Talc: usually massive near pegmatite-serpentinite contact
Tourmaline group: see schorl
Zoisite

Sparvetta quarry dumps

GEOLOGY

The majority of the minerals from these sites occur in a coarse-textured quartz and feldspar rock called pegmatite. In general, the coarser the grain size of the pegmatite, the larger the crystals, such as tourmaline and muscovite. The distribution of the accessory minerals, as the minor ones are called, is often quite irregular. The pegmatite which contains these minerals formed by cooling and crystallization from a hot magma or solution. The solution flowed through fractures in dark-colored serpentinite rock, the major rock type in the area. Minerals such as antigorite, chrysotile, chromite, and talc are related to the serpentinite and crystallized earlier than the pegmatite minerals. Others, such as aragonite and "deweylite", were the last minerals to form as a result of recent alteration.

REFERENCES

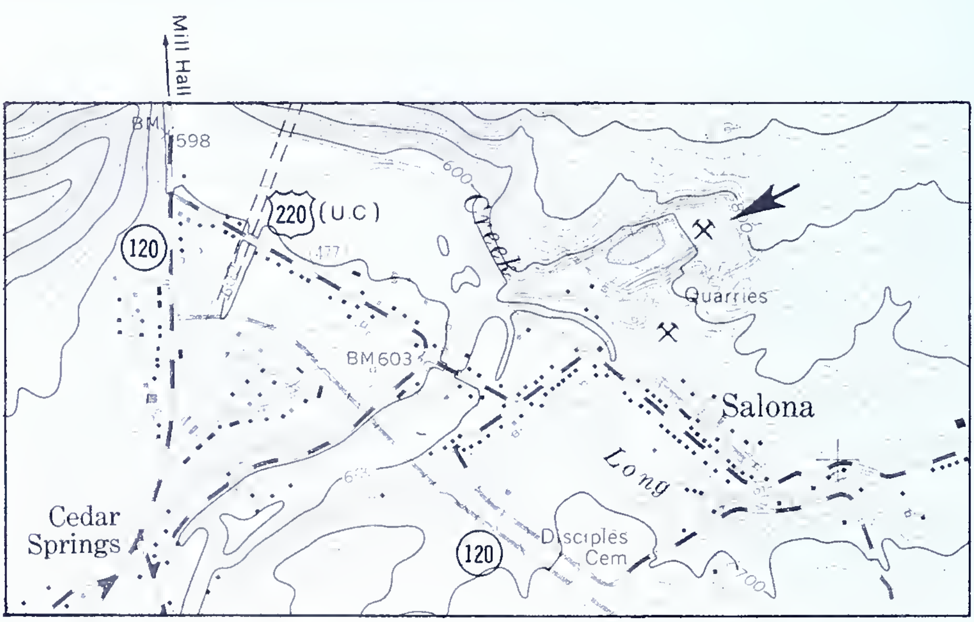
Bastin, E. S. (1910), *Feldspar deposits of the United States,* U.S. Geol. Survey Bull. 420, p. 63-72.

Stone, R. W. and Hughes, H. H. (1931), *Feldspar in Pennsylvania,* Pa. Geol. Survey, 4th ser., Min. Resource Rept. 13, 60 p.

SALONA CALCITE-DOLOMITE LOCALITY

LOCATION

The Salona quarry is an active limestone quarry located on the northern edge of the village of Salona (Mill Hall quadrangle) along Pa. Route 477, approximately 1 mile east of its junction with Pa. Route 120, in Lamar Township. The quarry can be seen on a hillside as one approaches the area from Interstate 80 on Pa. Route 120. This quarry is operated by the Lycoming Silica Sand Company (although there is no silica sand here). Permission to collect must be obtained at the quarry office, and a release form must be signed.



MINERALS

CALCITE: small white to clear rhombohedral crystals; large white cleavable masses, some produces strong "rotten egg" odor when broken, strongest odor from cleavable material with faint yellowish tint

Dolomite: crusts of white, curved rhombic crystals

Fluorite: small, light-purple cubic crystals

Quartz: small, transparent, doubly terminated crystals

Sulfur: uncommon; small yellow masses

GEOLOGY

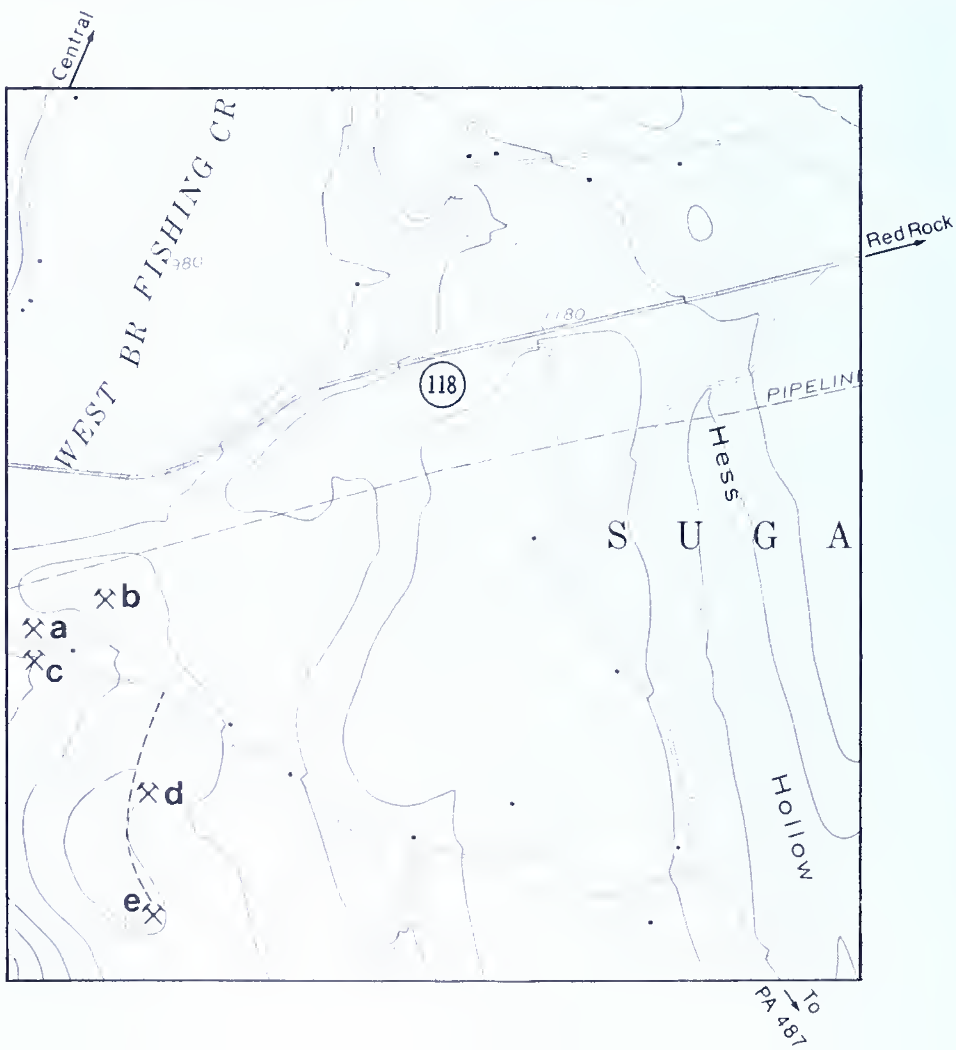
The carbonate minerals observed here are found in the Ordovician Loysburg and Hatter formations. After the formation of these limestones, folding and faulting created fractured zones containing open voids. Ground water, flowing through the limestones, dissolved and moved, in solution, some of the carbonate minerals, redepositing them as precipitates in the voids. It is in this way that the calcite crystals, cleavable masses of calcite, and dolomite crystals formed.

Two possible origins exist for the sulfur. One possibility is that the sulfur originated biogenically; that is, by the reduction of sulfates to sulfides and sulfur through the action of certain bacteria. These bacteria would also be responsible for the "rotten egg" odor mentioned above, because this is caused by the presence of hydrogen sulfide gas that is trapped in the rock and released when the rock is broken. A second less likely possibility is that the sulfur, hydrogen sulfur and hydrogen sulfide originated in hot, watery (hydrothermal) solutions that penetrated the limestone from depth.

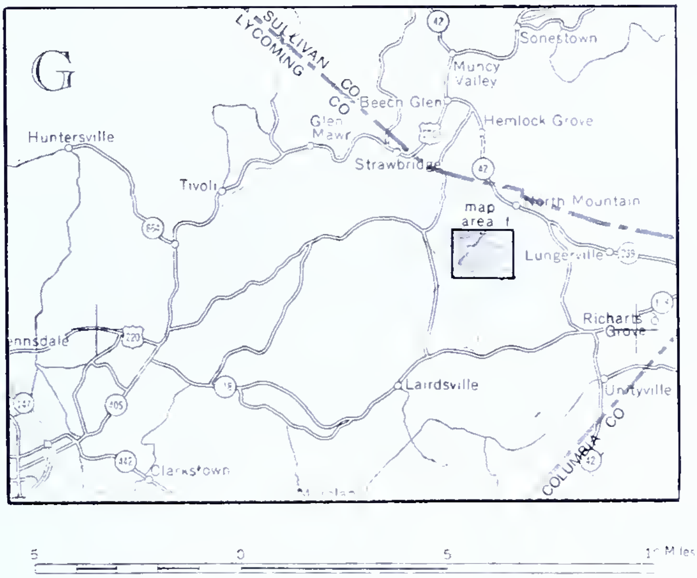
COPPER-URANIUM LOCALITIES

LOCATION

The northern Columbia County occurrences are located about 1.75 miles south of the village of Central, between Sugarloaf School and Tri Mills on the Elk Grove and Red Rock quadrangles, respectively. From Sugarloaf School proceed east for 0.31 mile via the road to the Arden Fritz house. After obtaining permission to collect, one can proceed to a pit west of the house at the same elevation (a); northeast 600 feet to a small trench near the crest of the hill (b); south across the road to a water-filled pit in the meadow (c); or 0.25 mile east

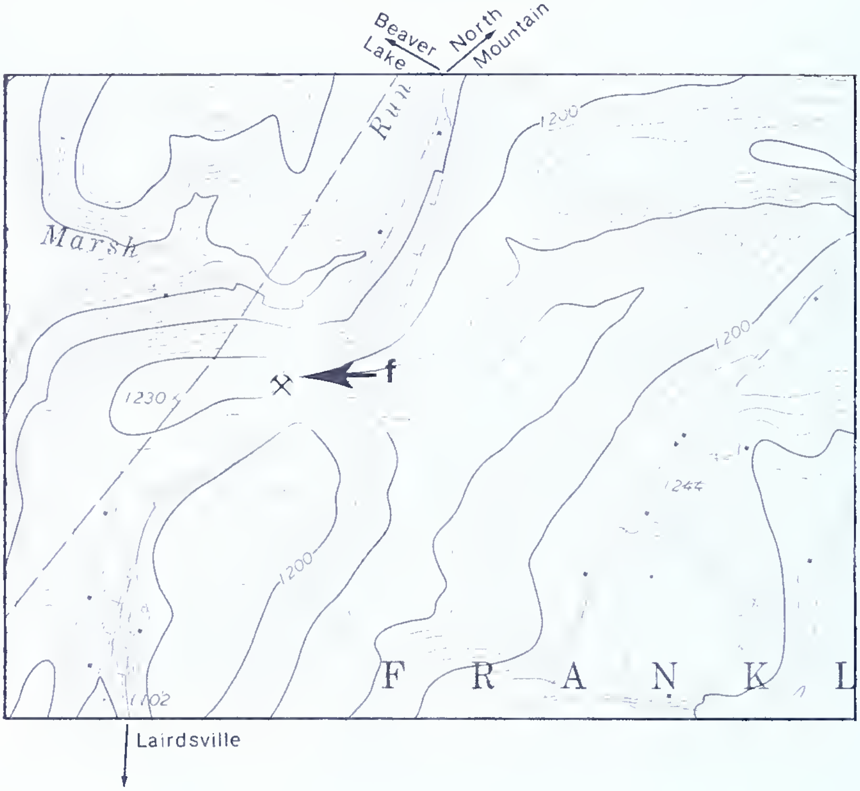


by road, then 1000 feet south on an old trail, then 200 feet southeast from the trail to a moderate-sized pit (d); or continue for 2000 feet instead of 1000 feet south of the road to the end of the trail and several small pits (e). This area includes McCauley (1961) prospect numbers 9-12.



The Lycoming County occurrence (f) is located about 2 miles southeast of Beaver Lake in the Sonestown quadrangle. The pit and dumps are behind a concrete building owned by David B. Weston, from whom permission to collect must be obtained. This is McCauley prospect number 17.

The Sullivan County occurrence is located along U.S. Route 220, northeast of Sonestown, in the Sonestown quadrangle. This new occurrence is exposed on the southeast side of U.S. 220, 1.70 miles northeast of the entrance road for the cemetery on the north side of Sonestown. The uranium and copper minerals are exposed from 250 to 275 feet northeast of highway survey marker 3/50. U.S. 220 is a busy highway, so one should pull well off the highway and be very cautious when collecting (location map unavailable at this time).



MINERALS

Columbia County

- Azurite: blue stains on siltstone
- Barite
- Bornite: orange; metallic when fresh, but tarnishes rapidly to peacock blue; lumps up to 1 inch with digenite replacing wood fragments at prospect d
- Cerussite: with bornite at prospect d
- Chalcopyrite
- Chalcocite: reported as small blebs and lenses up to a few inches in diameter
- Covellite: indigo blue; metallic; with digenite
- Digenite: blue; metallic; with bornite replacing carbonaceous fossil plant fragments
- Galena: uncommon
- MALACHITE: common; green crusts on siltstone or copper sulfide fragments
- Pyrite

Lycoming County

- Azurite: uncommon; blue coatings
- MALACHITE: common; green coatings and crystalline crusts
- Metatorbernite(?): intergrown with torbernite(?)
- Metazeunerite: green micaceous grains along carbonaceous fossil plant fragments and fracture surfaces
- Torbernite(?): greenish-yellow uranium-rich minerals in elongate patches replacing carbonaceous plant fragments

Sullivan County

- Apatite group: species unknown; as fossil fish plates
- Beta-uranophane: fibrous, pale-yellow coatings on red siltstone
- MALACHITE: green to bluish green
- Metazeunerite: small, greenish, micaceous scales on gray siltstone
- Uranophane: yellow coatings on gray siltstone
- Uranospinite(?): with metazeunerite

GEOLOGY

The copper and uranium minerals occur in Upper Devonian Catskill siltstones. In general, the interesting minerals occur in gray to greenish colored rocks rather than the usual red color rocks of the Catskill Formation. This type of occurrence is similar to the fossil stream channel uranium deposits of Colorado and Utah. The best specimens occur where copper or uranium minerals have replaced carbonaceous plant fragments. At some localities, small quantities of unreplaced carbonaceous material, resembling anthracite, remains. Rather curiously, some of the same outcrops that contain terrestrial plant remains also contain calcareous zones of marine fossils. These zones are less resistant to weathering and leave behind a brown, spongy-looking rock. Some say the copper and uranium minerals formed when the sediments were deposited or soon after; others say they formed from hot solutions at a later date.

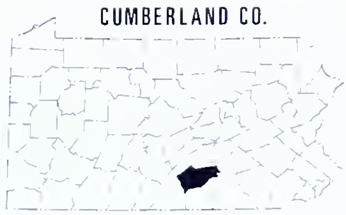
SIMILAR OCCURRENCE

Millview, Sullivan County

REFERENCE

McCauley, J. F. (1961), *Uranium in Pennsylvania,* Pa. Geol. Survey, 4th ser., Min. Resources Rept. 43, p. 17-68.

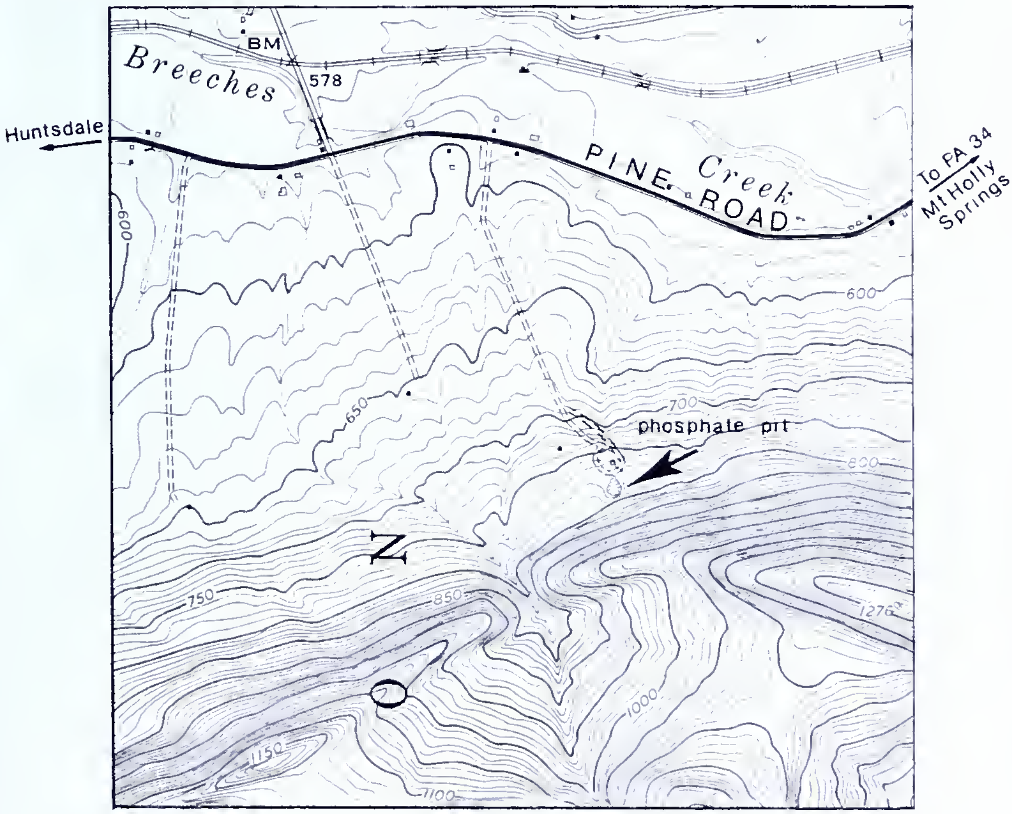
NOTES



MOORS (MOORES) MILL PHOSPHATE LOCALITY

LOCATION

This locality lies 3.5 miles west of Mt. Holly Springs and about 2.5 miles east of Huntsdale in the Dickinson quadrangle. One large pit, about 100 feet in diameter and 25 feet deep, and adjacent smaller trenches and dumps may be reached by turning south from Pine Road onto a dirt road nearly opposite the Reichard's fertilizer plant. The dirt road ends at the mine dumps on the north flank of South Mountain but trails leading from the mine criss-cross South Mountain. The mine property is privately owned and permission to collect must be obtained.



The mine was opened in 1900 and a mill for the extraction of phosphorus from the ore was built near the mine in 1902. Records show that in 1905 about 400 tons of ore were mined and reduced in the American Phosphorus Company furnaces. Milling operations moved to York Haven in 1906. The output of the mill was phosphorus, used chiefly for making matches. Mining ceased by 1907.

MINERALS

Apatite group(?): species unknown; reportedly associated with strengite

Beraunite: radial clusters of orange-red microcrystals

Cacoxenite: radial clusters of yellow-orange microcrystals

Cryptomelane: black lumps, some botryoidal, from east side of open pit

GOETHITE: "limonite"; massive; coating on wavellite crystals; also earthy masses

Kaolinite: massive; associated with chalcedony, wavellite, and strengite

Pyrolusite: dendrites; also on wavellite and chalcedony

Quartz: generally no crystal forms; also banded chalcedony

Strengite: translucent grayish-white to slightly greenish radial clusters; may be concentrically banded in globular clusters; microcrystals

Turquoise: small, blue masses in clay; unsuited for lapidary

Variscite(?): probably the ferrian variety redondite in clear crystals; within the strengite-variscite solid solution series

WAVELLITE: white radial clusters of prismatic needles; botryoidal; massive; also grayish (manganese) or yellowish (iron) resulting from included oxides; rarely in long prismatic single crystals with basal pinacoid terminations; microcrystals abundant

GEOLOGY

The wavellite is closely associated with the deposition of manganese. Crystal clusters often contain concentric black bands of pyrolusite; hence the two probably formed at the same time. The minerals occur in clay. The phosphate replaces both clay and chert although the clay replacement is more common. The chert occurs as irregular masses and contains fragments of both clay and milky quartz (a "breccia") which are likewise replaced by the phosphate. Thus, the wavellite is a secondary mineral and the result of residual accumulation under weathering conditions. This occurrence is near the base of the Cambrian Tomstown dolomite and a brecciated (faulted?) contact with the Antietam quartzite.

Mining was by open pit to a depth of about 30 feet where water halted the operation. The deposit had a width of 40 to 50 feet, with a depth ranging from a few feet on the valley side to 50 feet on the mountain side, and an undetermined length. Wavellite occurs in the same geologic horizon and association at several locations along the north slope of South Mountain between Mount Holly Springs and Walnut Bottom.

SIMILAR OCCURRENCES

Reading Banks and Wharton manganese mine, Cumberland County

REFERENCES

Gordon, S. E. (1922), *The mineralogy of Pennsylvania,* Acad. Nat. Sci., Philadelphia, Spec. Pub. 1, p. 158.

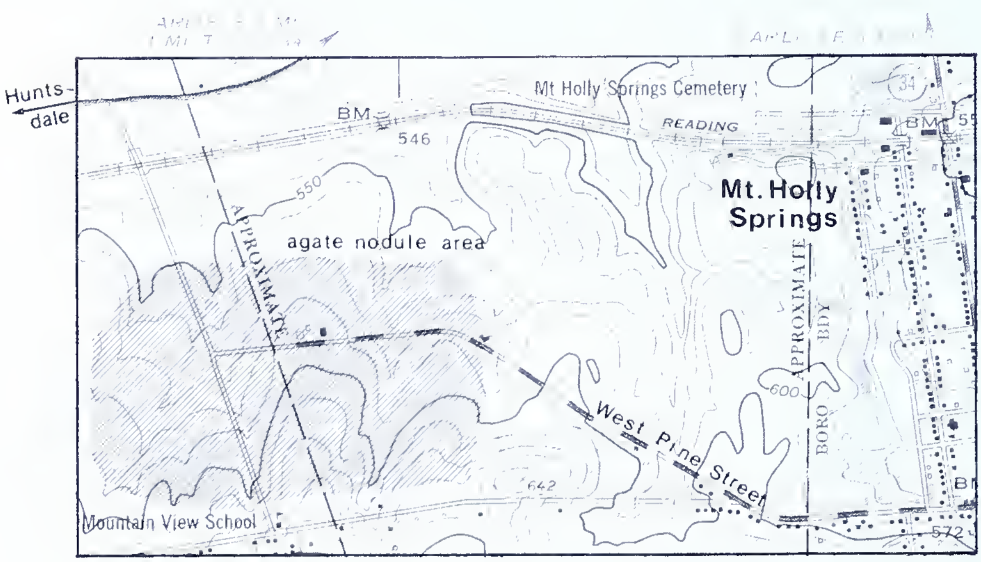
Stone R. W. (1939), *The minerals of Pennsyvlania – non-metallic minerals,* Pa. Geol. Survey, 4th ser., Min. Resources Rept. 18, p. 25-26.

Stose, G. W. (1907), *Phosphorus ore at Mt. Holly Springs, Pennsylvania,* U.S. Geol. Survey Bull. 315, p. 474-483.

MT. HOLLY SPRINGS AGATE LOCALITY

LOCATION

The agate locality near Mt. Holly Springs is located 1.2 miles west of the borough in the Mt. Holly Springs quadrangle. Take Pa. Route 34 (Baltimore Street) to the brownstone bank building, then west on West Pine Street for 0.4 mile to where the road forks, bear right, and at approximately one mile west of the bank building there are two farmhouses on the north side of the road. The fields south of these farmhouses contain the best chalcedony and agate concretions. Collecting is excellent along a small, intermittent stream. Rock piles along the stream are good collecting sites; also along fences and the edges of fields which have been cleared. Permission to collect must be obtained from the nearby owner of the farm and at no time should unharvested crop lands be entered.



MINERALS

QUARTZ: vein; milky, coarsely crystalline; sometimes drusy
var. agate, light to dark gray; tan to medium brown; translucent; many chip-fragments that will provide excellent tumbling material;
var. chalcedony, elongate to oval concretions; semi-banded, no sharp contacts between bands; light-gray to dark-gray bands most common; geodes rare but reported; some banded masses over a foot in diameter

GEOLOGY

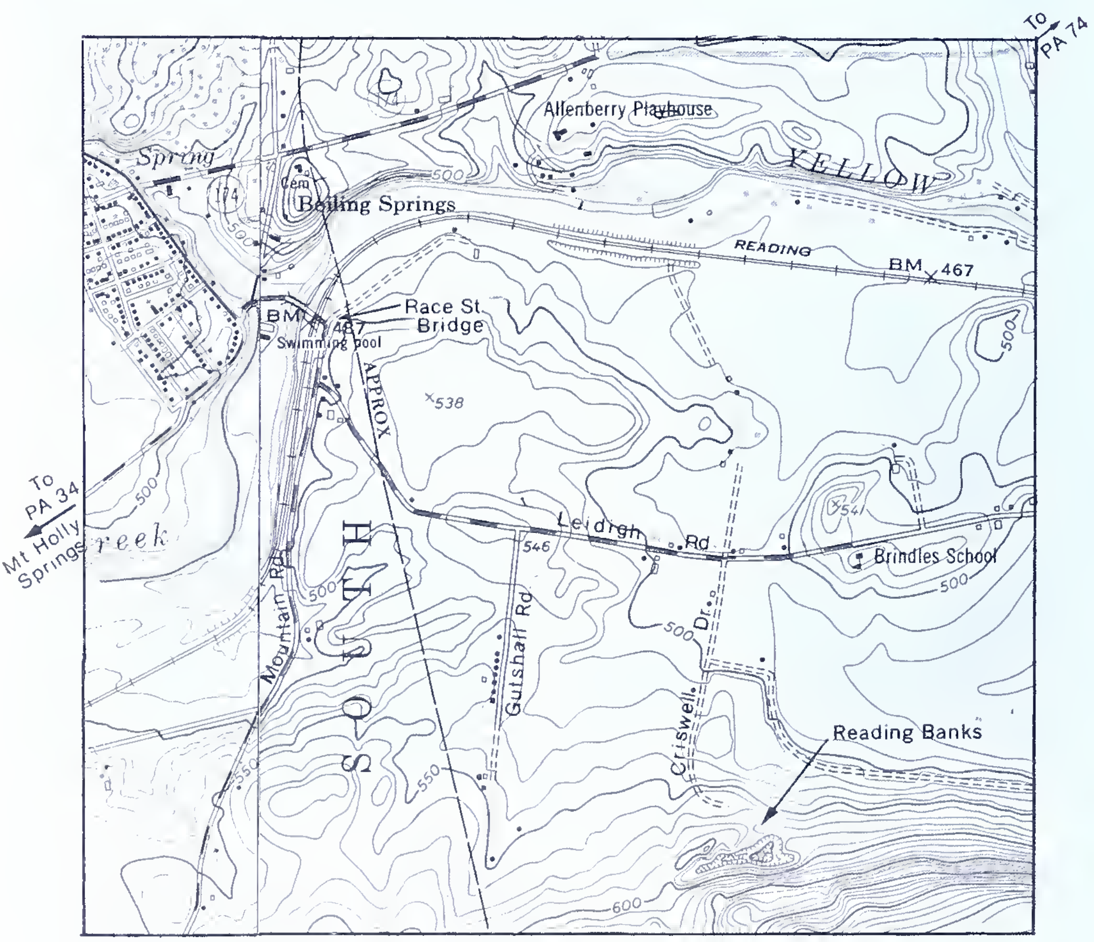
The agate and chalcedony are found loose in the soil. They occur as nodules in the Tomstown dolomite of Cambrian age and weather out of the bedrock. These concretions are often referred to as "thunder eggs" from an ancient Greek belief that they formed during thunder storms and dropped from the sky. The banding in most of the concretions is highly irregular; not the sharp, distinct banding of the Mexican and Lake Superior "fortification agates". The cream-colored chalcedony bands and patches are milky, a result of aggregates of differently oriented small quartz crystals. The darker bands tend to be brown to gray in color.

Typical "Mt. Holly" Agate

READING BANKS MANGANESE LOCALITY

LOCATION

The Reading Banks manganese mineral locality is located 1.4 miles southeast of Boiling Springs in the Mechanicsburg quadrangle. After crossing the Race Street bridge over Yellow Breeches Creek in Boiling Springs, turn right (south) onto Mountain Road and proceed for 0.1 mile, then turn left (east) onto Leidigh Road and proceed for 0.8 mile. Turn right (south) here onto Criswell Drive and proceed for about 0.3 mile. Obtain permission to park near where the road becomes poor and walk uphill on the lane through the George Beck property (obtain permission) to the open pit.



The best manganese minerals can be collected from the steep, north face of the open cut and the best goethite at the extreme west end of the bottom of the pit.

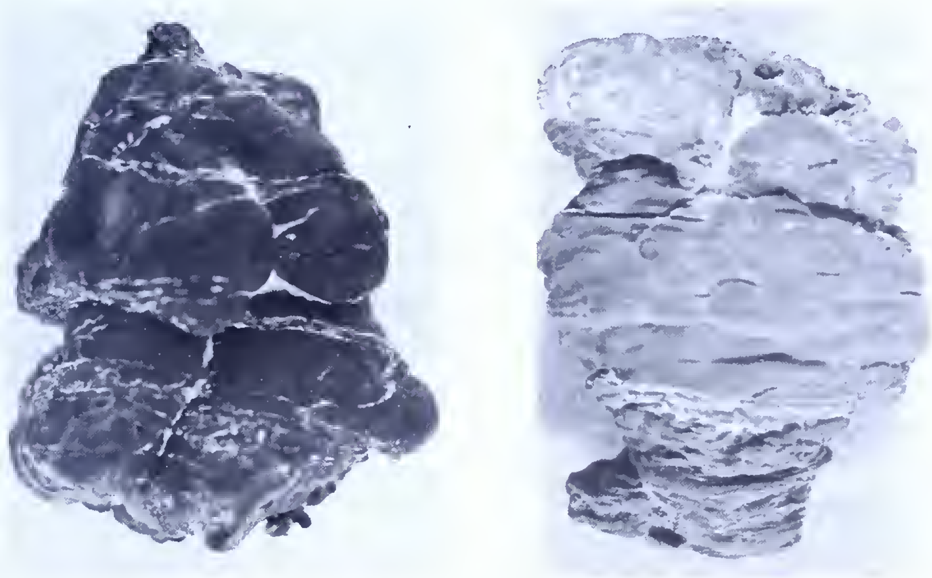
MINERALS

CRYPTOMELANE: hard steel-gray, metallic with botryoidal or mammillary surface structure and internal colloform banding; also dull-gray nodules with a variety of peculiar shapes

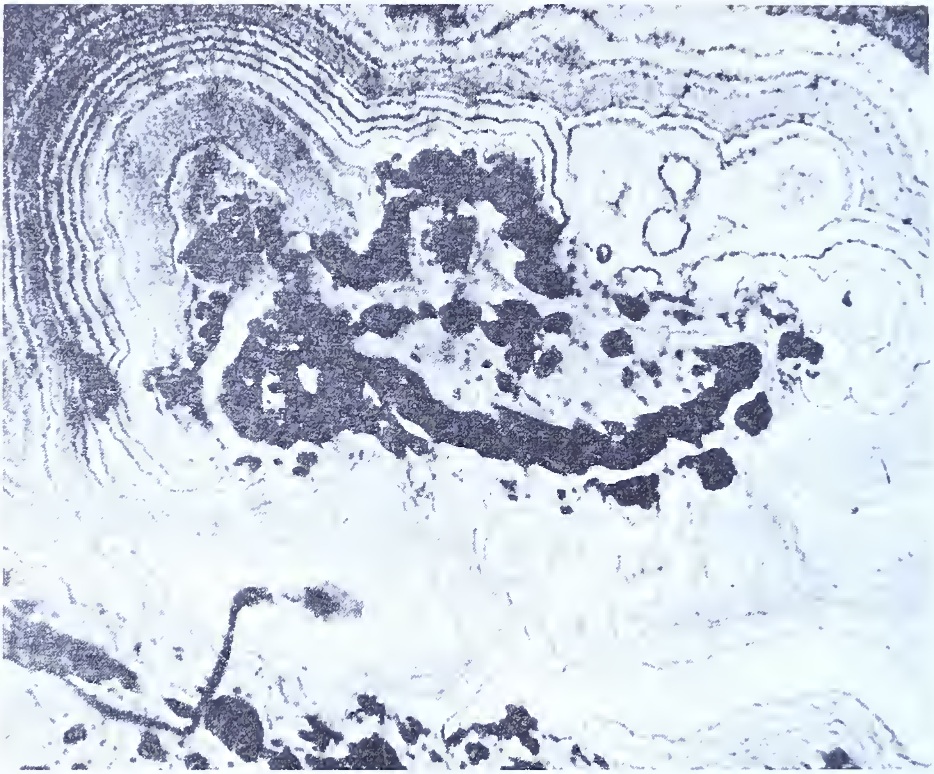
GOETHITE: shiny black "limonite" inside hollow bombshell iron ore

Lepidocrocite: uncommon; colloform bands of reddish brown, micaceous scales with goethite

Manganite(?): reported as gray to gray-white, coarse-grained veinlets and clusters of radial prismatic crystals with excellent colloform banding (Foose, 1945, p. 117); samples fitting this description collected recently have been shown to be pyrolusite



Cryptomelane nodules from the Reading Banks area



Intricate colloform banding of cryptomelane (white). Some bands are selectively replaced by "limonite" (100x, from Foose, 1945, pl. 16a).

Pyrolusite: very soft, sooty black nodules that write on paper; small vugs with velvet-like black crystals; radiating, prismatic with colloform banding

Romanechite(?): resembles cryptomelane except for a blacker color and a positive flame test for barium and negative for potassium; reported as "psilomelane" by Foose (1945, p. 78-79)

GEOLOGY

Although iron ore was reported to have been mined during the Revolutionary War, the serious mining was done between 1872 and 1893 by the Philadelphia and Reading Coal and Iron Company. About 700,000 tons of ore were produced from the open cut and underground drifts (now caved in) but the ore produced poor iron because the technology to take advantage of high manganese iron ore was not available. By 1940 manganese was in demand and a small amount of manganese-rich ore was produced.

The ore minerals occur in clay weathered from the Cambrian Tomstown dolomite. The impervious, resistant Antietam sandstone lies just beneath the ore. The iron and manganese were probably leached from the overlying dolomite and transported by reducing, non-alkaline ground water.

SIMILAR OCCURRENCES

White Rocks, McCarrick prospect, Wharton mine, and Laurel Banks, all in Cumberland County

REFERENCES

Burton, S. E. and Sanford, R. S. (1949), *Investigation of Boiling Spring manganese-iron deposits, Cumberland County, Pennsylvania,* U.S. Bur. Mines Rept. Inv. 4436, 20 p.

Foose, R. M. (1945), *Manganese minerals of Pennsylvania,* Pa. Geol. Survey, 4th ser., Min. Resource Rept. 27, p. 74-85.

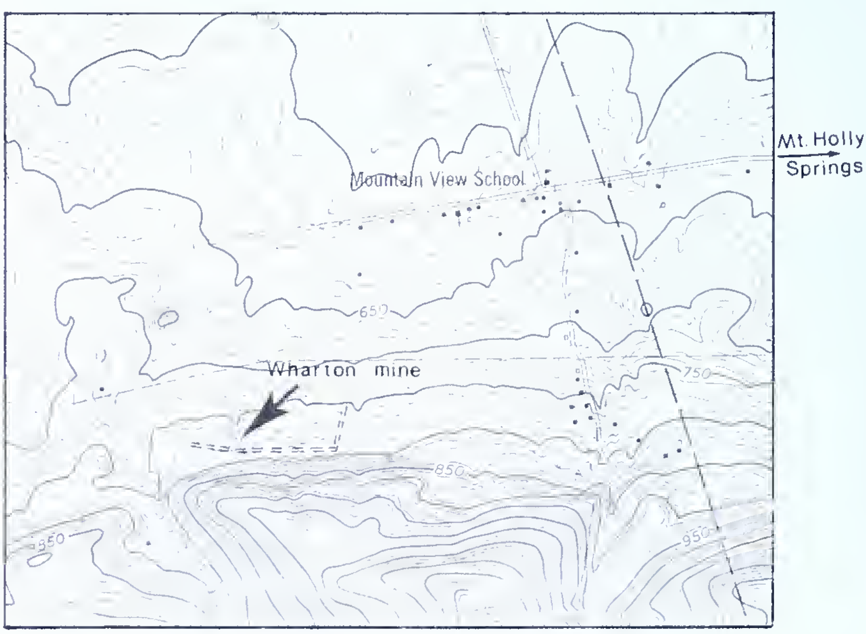
NOTES

WHARTON MINE-MANGANESE-WAVELLITE LOCALITY

LOCATION

The Wharton mine is located approximately 1.85 miles southwest of Mount Holly Springs at an elevation of 780 feet on the north flank of South Mountain (Mount Holly Springs quadrangle). A private unimproved road leads southwest toward the mine 0.2 miles west of the Mountain View School shown on the topographic map. The entire area is privately owned and permission to hike to the mine must be obtained.

Manganese ore was mined from this locality about 1880. A pit, about 125 × 125 × 30 feet, is water filled and readily visible aside the trail. High-grade manganese ore may be found mainly on the north side of the pit.



MINERALS

CRYPTOMELANE: massive; colloform-textured
Goethite: "limonite" coatings
Pyrolusite: soft; black; porous; dull, earthy luster
WAVELLITE: common; beautiful white radiating masses

GEOLOGY

The ore occurs in a weathered zone of the Cambrian Antietam quartzite. The minerals, cryptomelane and wavellite, occur as a replacement of brecciated quartzite and sandstone and the matrix between the fragments. The origin of these minerals was probably as low-temperature solutions moving into open spaces and around fragments. Exploration work in the early 1940's suggested the ore deposit was a small one and that it had been exhausted.

SIMILAR OCCURRENCES

Moors (Moores) Mill and Reading Banks, Cumberland County

REFERENCE

Foose, R. M. (1945), *Manganese minerals of Pennsylvania,* Pa. Geol. Survey, 4th ser., Min. Resource Rept. 27, 126 p.

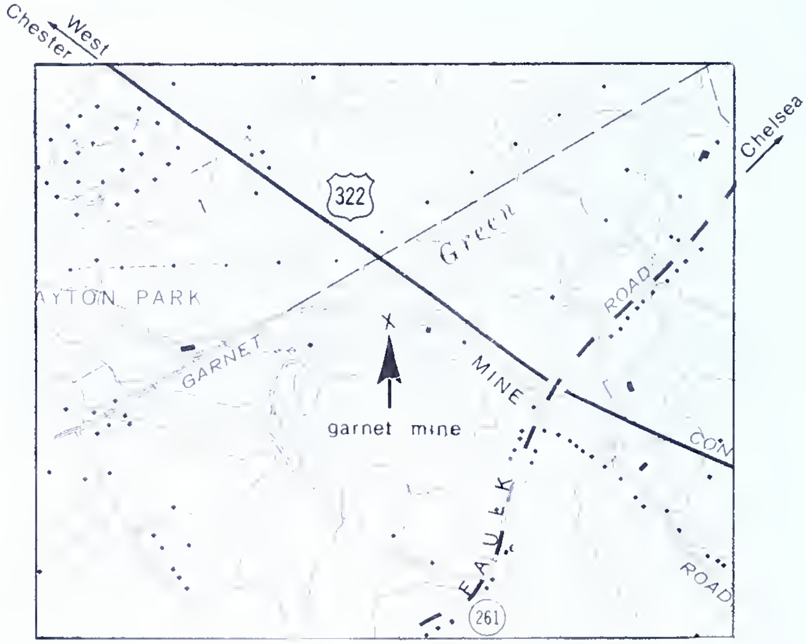
NOTES

BEHR GARNET MINE LOCALITY

LOCATION

Pits and dumps from an old garnet mine may be found approximately one mile southwest of Chelsea along the south side of Green Creek and Garnet Mine Road, parallel to the Conchester Pike (U.S. Route 322). This area is in the Marcus Hook quadrangle. A small paved parking lot by the creek on the north side of Garnet Mine Road is available. The mine dumps are private property and permission to enter must be obtained.

Garnet mining by Herman, Behr and Company took place here for many years. The mines opened about 1870 and continued to almost 1912. The mineral was marketed as an abrasive, or scouring and cutting material, as garnet paper and as garnet wheels.



MINERALS

GARNET GROUP: massive and in crystals; deep blood-red and pale-rose-pink; probably the species almandine (iron-aluminum garnet) and spessartine (manganese-aluminum garnet)

GEOLOGY

The garnets occur at the contact of serpentinite and gabbro. Green Creek marks the approximate contact in this area with the Precambrian(?) gabbro on the south side. Garnet is often an accessory mineral in gabbro and locally may be a garnet-rich differentiate of the gabbro.

REFERENCES

Bascom, Florence and others (1909), *Philadelphia Folio,* U.S. Geol. Survey, No. 162, 36 p.

Brown, A. P. and Ehrenfeld, Frederick (1913), *Minerals of Pennsylvania,* Pa. Geol. Survey, 3rd ser., Economic Rept. 9, p. 65.

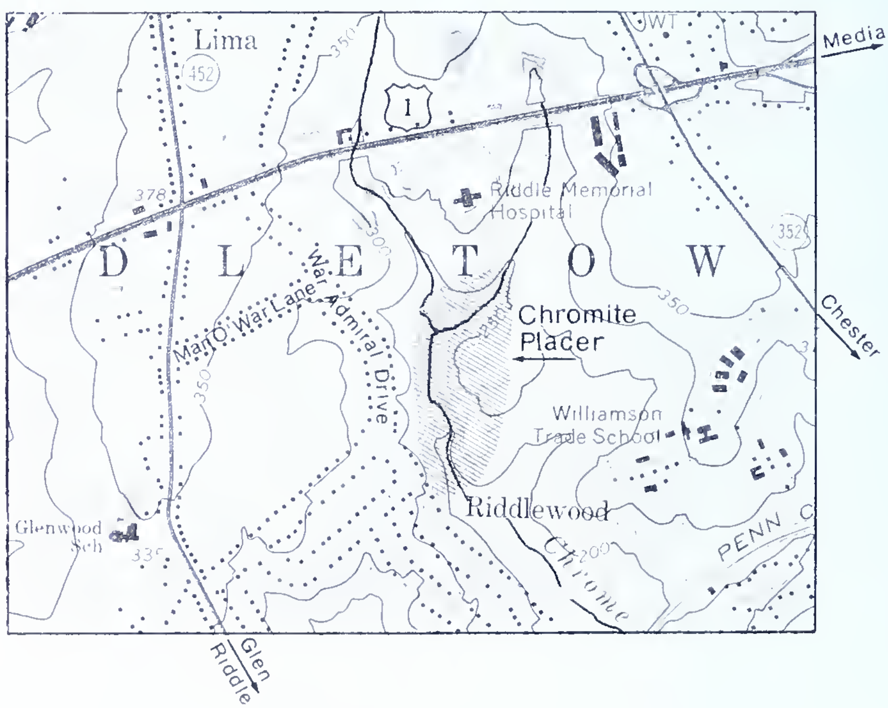
Hall, C. E. (1885), *Field notes in Delaware County,* Pa. Geol. Survey, 2nd ser., Rept. C5, p. 81.

NOTES

CHROME RUN CHROMITE PLACER

LOCATION

The Chrome Run chromite placer is in Riddlewood, 2.5 miles southwest of Media, in the Media quadrangle. The part of Chrome Run known to contain chromite is bounded by U.S. Route 1 (West Baltimore Pike), Pa. Route 352, a Penn Central railroad track, and Pa. Route 452. Access to Chrome Run is possible from Riddle Memorial Hospital or by obtaining permission to walk through a yard in the 0-100 block of War Admiral Drive. The area farther downstream, as well as other small streams in the area, may also contain small, but good placers. Simply walk along the creek and collect the coarsest black sand (concentrated heavy minerals) with a garden trowel. This may be further concentrated right in the creek with a gold pan.



MINERALS

Amphibole group: clear, emerald-green cleavages up to $^1/_8 \times {}^1/_2$ inch; probably the species anthophyllite with a trace of nickel

CHROMITE: sharp, lustrous octahedrons generally about $^1/_{16}$ inch, some up to $^3/_{16}$ inch; years ago, crystals up to one inch were common in the deeper stream gravels

Quartz: clear, single, doubly terminated crystals about $^1/_{16} \times {}^1/_8$ inch

Zircon: brilliant orange grains; fluorescent under short wave ultraviolet light; grains in the heavy sands

GEOLOGY

The chromite crystals now occurring in the black sands on the banks and gravel bars of Chrome Run have weathered out of the serpentinite rocks to the north and east of the creek. The serpentinites formed indirectly from molten magma that originally crystallized largely as forsterite (olivine group) with traces of chromite. After cooling, the forsterite hydrated to form serpentine group minerals. Present day erosion removes the slightly soluble serpentine, whereas the dense, resistant chromite accumulates on the bedrock surface and is subsequently concentrated as dark sand in areas of low water velocity in the streams.

Fairlamb's, Hibbard's, and other placers along Chrome Run and to the northeast produced about 500 tons of sand chromite before 1900. The placers were soon exhausted of commercial chromite and the serpentine itself only contains a few tenths of a percent chromite. As in the case of many gold and other heavy mineral deposits elsewhere, the placers were much richer than the original lode deposits.

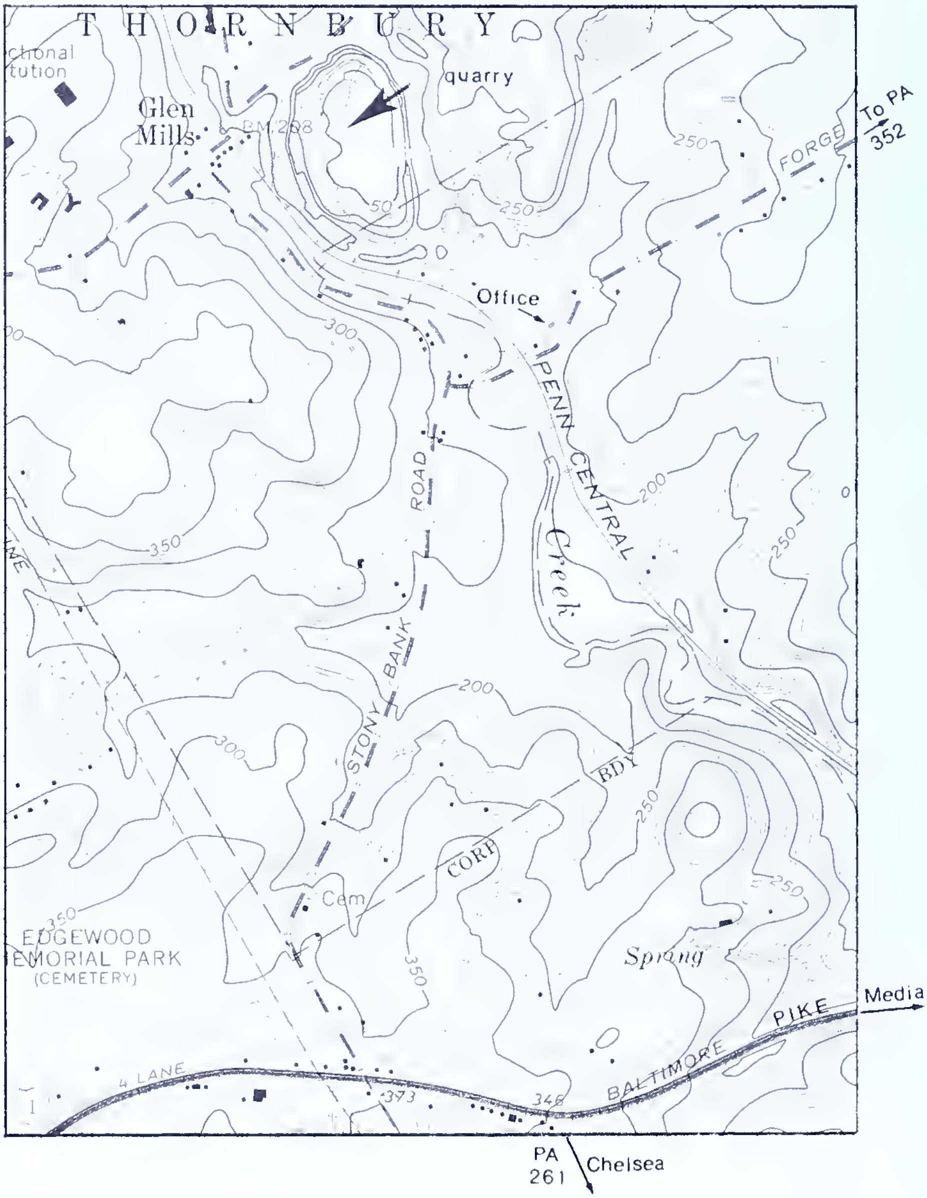
REFERENCE

Pearre, N. C. and Heyl, A. V., Jr. (1960), *Chromite and other mineral deposits in serpentine rocks of the Piedmont upland, Maryland, Pennsylvania, and Delaware,* U.S. Geol. Survey Bull. 1082-K, p. 79.

GLEN MILLS QUARRY — GARNET LOCALITY

LOCATION

The Glen Mills quarry of General Crushed Stone Company is in Thornbury Township about 5.5 miles west of Media (Media quadrangle). Take Stony Bank Road about one mile west of Wawa to Forge Road, then east on Forge Road across Chester Creek and under the Penn Central Railroad tracks. General Crushed Stone Company's office and quarry entr-



ance are immediately east of the railroad tracks. Release forms must be completed and signed at the office. Hard hats and safety glasses are required. Advanced arrangements must be made so as not to interfere with the normal operations of the quarry which include almost daily blasting. Collecting is permitted only on weekdays during normal working hours. Certain quarry walls are extremely hazardous and no climbing is permitted.

The Glen Mills quarry was first opened in 1884. In 1905, the General Crushed Stone Company started operation and it is now the largest quarry in the area. It is approximately 300 feet deep and even through Chester Creek is at a higher elevation, water seepage into the quarry is minimal. The crushed rock is used primarily for roadbed material and in blacktop produced on the premises.

MINERALS

Allanite: small, black crystals in microcline
Apatite group: probably fluorapatite, as pale bluish hexagonal prisms
BIOTITE: black
Calcite: white; cleavages; relatively pure
Chromite(?): small black grains disseminated in serpentine
Diopside (pyroxene group): in metamorphosed limestone beds (marble)
Epidote
GARNET GROUP: probably the species almandine; dark red; massive and crystals
Heulandite
Hornblende: green-black
MICROCLINE: cleavages; pink, some green
Molybdenite: silvery-blue, metallic flakes in almandine (?)
Muscovite (mica group): silvery-white books; upper level
Pyroxene group: see diopside

Quartz: massive; milky white and gray; amethyst rare
Schorl (tourmaline group): black crystals
Serpentine group: species unknown
Stilbite: orange crystals
Titanite (sphene): in marble beds
Zircon: small, sharp, brown crystals

GEOLOGY

The geology of this Precambrian area is extremely complex. A series of interbedded graywackes and carbonates (sedimentary rocks) along with graphitic gneiss (metamorphic rock) and intermediate to dark igneous rocks were folded and metamorphosed. Then all of the resulting rock types were deformed again and pegmatites were intruded. Fracturing of the total mass was probably the last event. Likewise, mineral occurrences and associations are varied. Some of the minerals, like diopside, titanite, and garnet are associated with the metamorphism while others like microcline, quartz, biotite and muscovite are associated with the intrusion of pegmatites.

REFERENCES

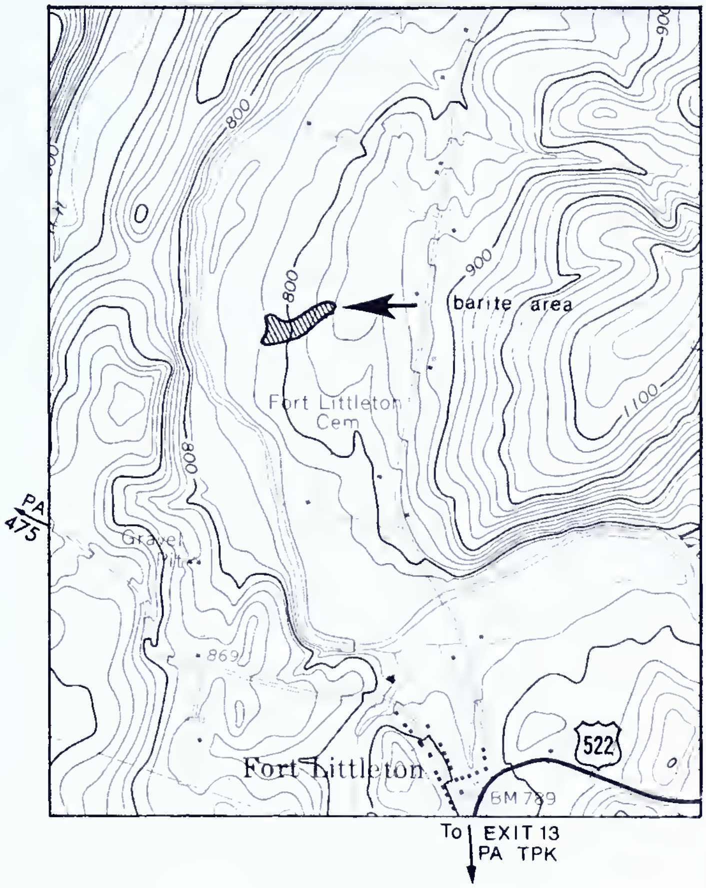
Goodwin, B. K. (1964), *Guidebook to the Philadelphia area,* Pa. Geol. Survey, 4th ser., Gen. Geology Rept. 41, 189 p.

Parrott, W. R., Jr. (1974), *Glen Mills Quarry,* Guidebook, 39th Field Conf. Pa. Geologists, Pa. Geol. Survey, 104 p.

FORT LITTLETON BARITE-CHALCOPYRITE LOCALITY

LOCATION

The Fort Littleton barite prospect is located 0.85 mile north-northwest of Fort Littleton, Dublin Township, in the Burnt Cabins quadrangle. This area is 1200 feet north-northwest of the Fort Littleton Cemetery. The best collecting is in a wide tree row between two cultivated fields, and can be found by walking about 800 feet north along Little Aughwick Creek on the lane from the Fort Littleton Cemetery parking area. At this point the lane ends in an open field and the tree row to the right should be followed north for about another 500 feet. Here, there are a few shallow open pits. Barite float



continues across the fields but these should not be entered when the fields are planted. Seek permission from farm owner before collecting.

MINERALS

BARITE: both as white to gray-white, fine-grained, porcelain-like masses and masses of coarse cleavages
Calcite: massive, cleavages
CHALCOPYRITE: disseminated grains up to $^3/_{16}$ inch; most common in samples in which the clay-carbon (black shaly) insoluble residue has accumulated
Dolomite: massive, cream colored cleavages
Malachite: green coating around weathered chalcopyrite
Pyrite: small crystals reported
Quartz: massive

GEOLOGY

The barite and chalcopyrite occur along a northeast-trending fracture in upper Silurian sedimentary rocks. The barite occurs both as coarse cleavages in open spaces of crushed limestone breccia and as fine-grained masses which replaced the limestone.

The barite and chalcopyrite were probably deposited from warm saline solutions. Traditionally, such solutions are called hydrothermal. Whether or not these solutions were derived from deeper molten igneous rocks is not known.

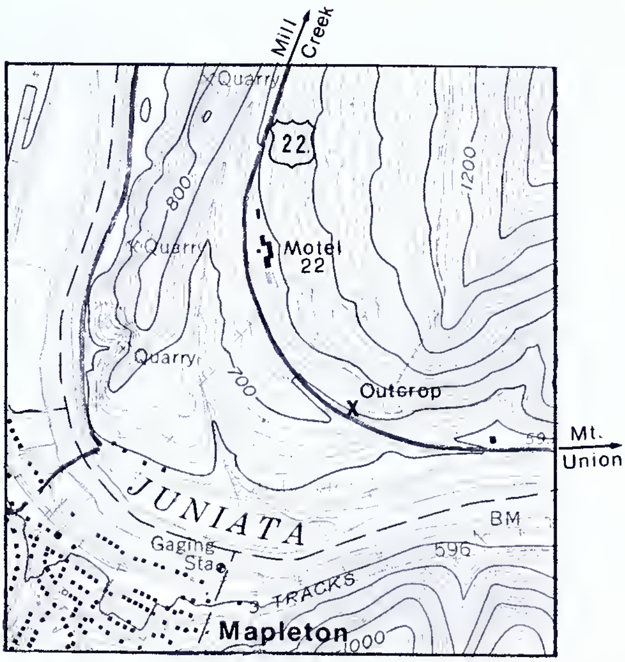
REFERENCE

Socolow, A. A. (1959), *Geology of a barite occurrence, Fulton County, Pennsylvania,* Pa. Geol. Survey, 4th ser., Inf. Circ. 17, 4 p.

MOTEL 22 GALENA LOCALITY

LOCATION

The Motel 22 galena locality is on the northeast side of U.S. Route 22 near Mapleton, in the Mount Union quadrangle. The location is about 1500 feet (0.3 mile) west-northwest of the intersection of the road from Mapleton onto U.S. Route 22 and 1800 feet (0.4 mile) southeast of the office for Motel 22. It is advisable to park at the roadside table to the southeast of the occurrence. Because the traffic is heavy, the location should not be considered for children, and adults must exercise extreme caution. The woods off the road right-of-way is the private property of Mr. Harry H. Boettcher.



MINERALS

Anglesite: chalk-white coatings on galena lumps near the surface

Apatite group: hydroxyapatite(?) as white microcrystals on pyrite; fluorapatite(?) a possibility

Chalcopyrite: sparse; tiny grains

GALENA: masses weighing up to 1 pound in quartzite; sawed slabs have a shimmery gleam from the curved cleavage

Plumbojarosite: yellow-brown coatings on galena (intermediate between beudantite(?) and plumbojarosite)

PYRITE: disseminated grains and modified cubic crystals

Pyromorphite: white fibrous and gray prismatic crystals; X-ray diffraction suggests the hydroxyl variety

Quartz: vugs with 1/16 inch clear, colorless crystals

SPHALERITE: red, orange, yellow, brown, and black; the most attractive are small red crystals in quartz vugs

GEOLOGY

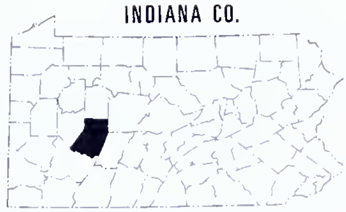
The host rocks are the Silurian Tuscarora and Rose Hill formations. The Tuscarora quartzite probably contained disseminated pyrite when deposited. Long after this sandstone was lithified, the rocks were faulted into contact with the Rose Hill shale. The tough sandstone was broken into angular pieces forming a breccia. Hydrothermal solutions later filled in the open spaces between the fragments with the sulfides, galena and sphalerite.

SIMILAR OCCURRENCES

Milesburg Gap, Centre County; 0.7 mile east of Mapleton, Huntingdon County; and numerous old ganister quarries along Jacks Mountain, Huntingdon County

REFERENCE

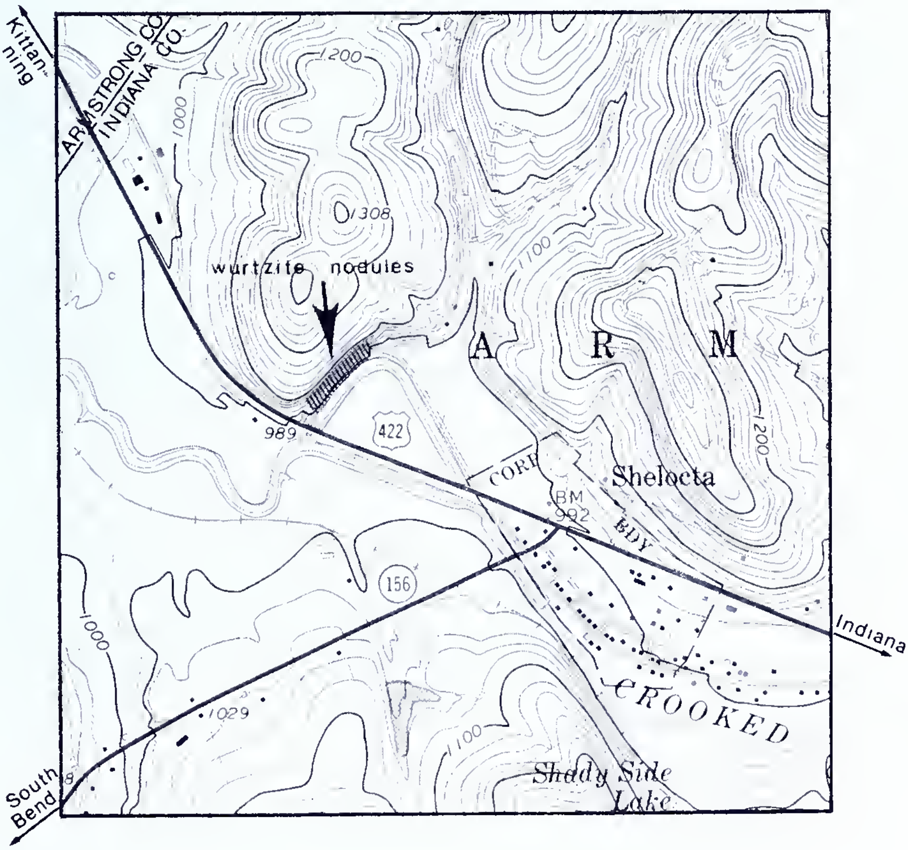
Smith, R. C., II (1974), *Zinc and lead occurrences in Bedford, Blair, and Huntingdon Counties*, Pa. Geol. Survey, open file 16, 80 p.



SHELOCTA WURTZITE LOCALITY

LOCATION

This locality is on an embankment near a former meander of Crooked Creek in Armstrong Township on the Elderton quadrangle. It is reached by turning north on a secondary road that intersects U.S. Route 422 about 0.5 mile east of the junction of U.S. Route 422 and Pa. Route 156 in Shelocta. Caution should be exercised because a spur from this secondary road is sometimes used as a drag strip.



MINERALS

Barite: in nodules as small, platy crystals
Chalcopyrite: brassy yellow
SIDERITE: as nodules containing other minerals
Sphalerite: curved, platy material with wurtzite; tiny crystals embedded in platy barite
Wurtzite: radiating groups of crystals with acute pyramidal terminations; 6H and 4H polymorphs present

GEOLOGY

The nodules containing the collectable minerals are in a bed above the Brush Creek limestone of the Glenshaw Formation of the Pennsylvanian Conemaugh Group. The concretions formed under marine conditions prior to the lithification of the enclosing sediment. During or after lithification of the sediment, shrinkage cracks formed in the concretions. These cracks were later filled by the minerals that were probably precipitated from ground water.

This locality is the first wurtzite occurrence discovered in western Pennsylvania, and is the type locality for the 4H and 6H polymorphs of wurtzite.

SIMILAR OCCURRENCES

Wittmer, Allegheny County; East Unity Church and Sedwicks Mill, Butler County; Sugar Hill, Jefferson County; Franklin, Venango County; Donohoe, Westmoreland County

REFERENCES

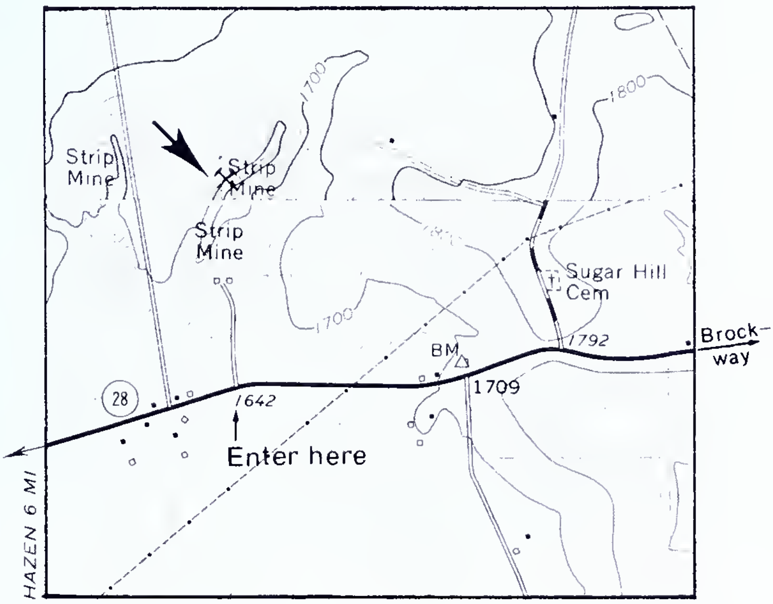
Frondel, Clifford and Palache, Charles (1950), *Three new polymorphs of zinc sulfide,* Am. Mineralogist, v. 35, p. 29-42.

Seaman, D. M. and Hamilton, Howard (1950), *Occurrence of polymorphous wurtzite in western Pennsylvania and eastern Ohio,* Am. Mineralogist, v. 35, p. 43-50.

SUGAR HILL SIDERITE NODULE LOCALITY

LOCATION

The Sugar Hill limestone quarry is located 0.4 mile north of Pa. Route 28 at a point 3.9 miles along Pa. Route 28 west of the bridge in Brockway. This is 1.45 miles northwest of Beechton, Snyder Township. The quarry is in the southern part of the Carman quadrangle but entered from the northern part of the Falls Creek quadrangle. The property is owned by the Sugar Hill Limestone Company (office at 11 Brown Street, Reynoldsville, Pennsylvania) which still operates a plant between the quarry and Pa. Route 28. The company's permission is required for entry. The best nodules occur on the northwest side of the quarry, about halfway back. Hard hats are required.



MINERALS

BARITE: clear, colorless cleavages in siderite nodules

Calcite: clear, colorless cleavages in siderite nodules and as fossils in the "Buhrstone ore"; difficult to distinguish from barite except that the calcite fizzes with dilute acid

Chalcopyrite: grains and tetrahedrons in siderite nodules

Gypsum: small, white crystals near altered pyrite

Pyrite

SIDERITE: both as very hard fossil hash forming the four-inch thick "Buhrstone iron ore bed" on top of the Vanport limestone and as tough nodules in the first five feet of shale overlying the Vanport

SPHALERITE: common; golden-orange to dark-brown cleavages up to ½ inch in siderite nodules

Wurtzite(?): uncommon; hexagonal prisms

GEOLOGY

The siderite nodules which contain interesting minerals are limited to the first 5 feet over the Vanport limestone. The Vanport Member is gray to tan micritic (extremely fine grained; chemically precipitated) marine limestone which is part of the Pennsylvanian-aged Clearfield Creek Formation. The Vanport occurs beneath the Lower Kittanning No. 1 coal and above the Upper Clarion (Scrubgrass or Clarion No. 2) coal, but these may not both occur at any given locality. The coals are nonmarine sedimentary rocks whereas the Vanport and overlying nodule zone are known to be marine because of fossils such as the calcite-filled corals and large crinoid stems in the "Buhrstone" siderite bed on top of the Vanport.

The barite, sphalerite, and chalcopyrite occur in contraction cracks in the nodules. The mineralization never extends to the outside of the nodule. Thus, the necessary metals are believed to have been present within the nodules as they formed in the marine sediments.

SIMILAR OCCURRENCES

Donohoe Station, near Greensburg, Westmoreland County, and Shelocta, Indiana County

REFERENCE

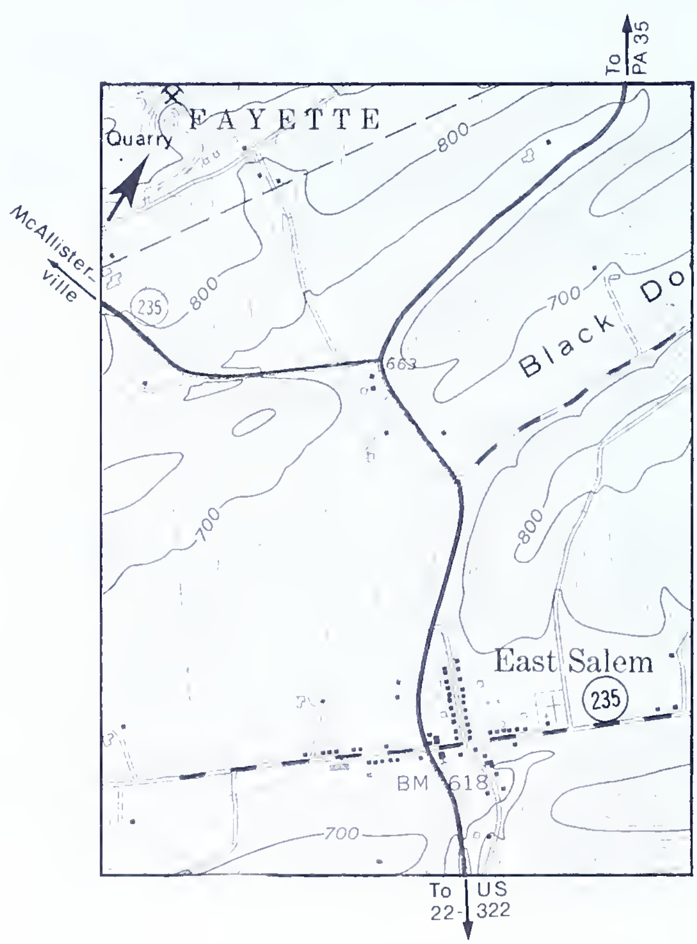
Seaman, D. M. and Hamilton, Howard (1950), *Occurrence of polymorphous wurtzite in western Pennsylvania and eastern Ohio,* Am. Mineralogist, v. 35, p. 43-50.

Sugar Hill limestone quarry. Arrow shows siderite nodule horizon

EAST SALEM CELESTINE LOCALITY

LOCATION

The Susquehanna Quarry Company of the Koppers Company operates a limestone quarry 4.5 miles north of Thompsontown on Lost Creek Ridge. This quarry, located in the Millerstown quadrangle, Fayette Township, may be reached by taking the East Salem-Thompsontown exit from U.S. Route 22-322, traveling north through the village of East Salem and continuing west on Pa. Route 235 to Quarry Road. A turn to the north on Quarry Road will take you to the main



office where permission must be obtained before entering. Hard hats are mandatory. In the past this quarry has been known as the D. E. Smith Quarry and the Juniata Limestone Company quarry.

MINERALS

Aragonite: flowstone, dripstone; radiating, banded
Barite(?): white
CALCITE: white and brown cleavages and crystals
CELESTINE: small to medium sized crystals; light to medium blue
Dolomite: pink crystals
Fluorite: purple; cleavages, massive
Pyrite: small cubes
Pyrrhotite(?): in calcite crystals
Strontianite: tufts of small, white crystals

GEOLOGY

The quarry is located on the crest of the flat-topped Lost Creek anticline where the dip of the beds is very nearly horizontal. The rocks quarried here include a few feet of the upper part of the Silurian Tonoloway Formation and about 50 feet of the lower part of the overlying Silurian-Devonian Keyser Formation. The floor of the quarry at its deepest points along the northwest wall exposes the top of the Tonoloway Formation, and it is here that the celestine may be found. Calcite-filled vugs in joints and bedding planes are characteristic of this horizon.

SIMILAR OCCURRENCES

Bellwood, Blair County; Meckley quarry, Northumberland County; Allenport, Huntingdon County; Lime Bluff, Lycoming County; Faylor quarry at McVeytown, Mifflin County; Faylor quarry at Winfield, Union County

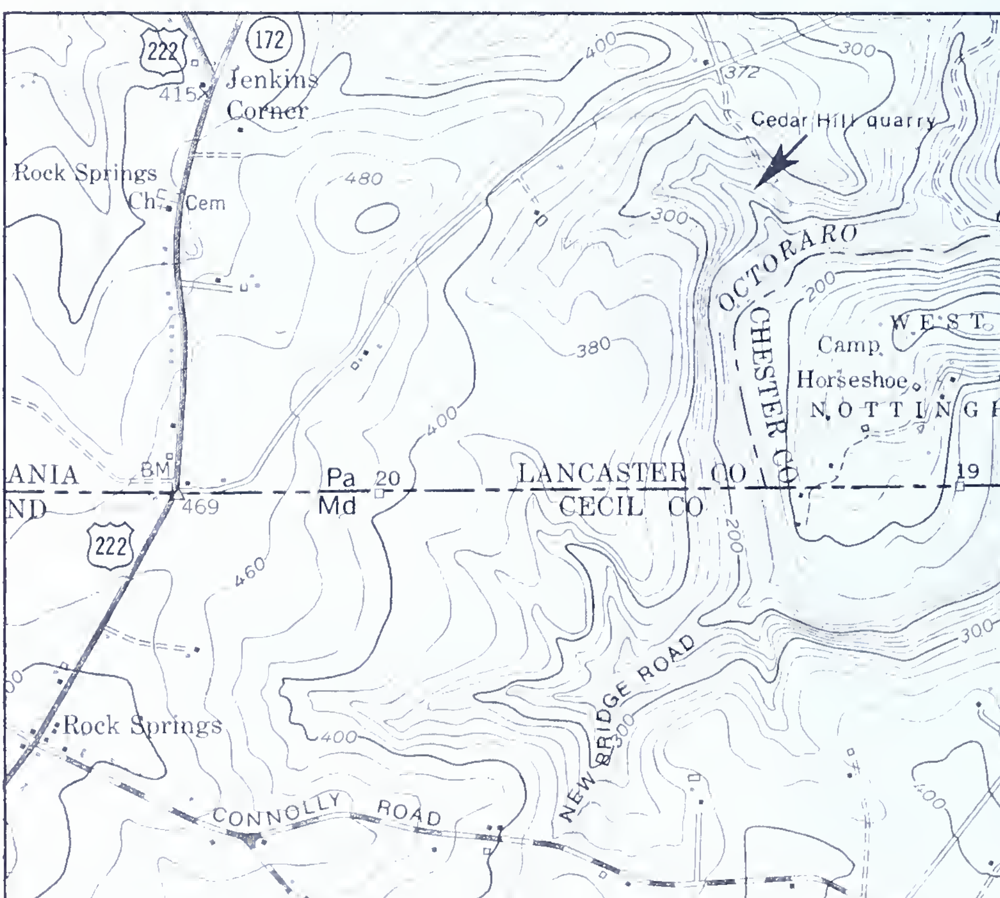
REFERENCE

Faill, R. T. and Wells, R. B. (1974), *Geology and mineral resources of the Millerstown quadrangle, Perry, Juniata, and Snyder Counties, Pennsylvania,* Pa. Geol. Survey, 4th ser., Atlas 136, 276 p.

CEDAR HILL SERPENTINITE QUARRY

LOCATION

The Cedar Hill quarry is located in Fulton Township, Conowingo Dam quadrangle. The quarry may be reached by turning east from U.S. Route 222 at the Pennsylvania-Maryland state line, and following the road for approximately one mile to the quarry. This is an active quarry, obtaining massive serpentinite, primarily for road material. It is operated by D. M. Stoltzfus and Son, Inc., Talmage, Pa. 17580. Collecting is allowed only on Saturday afternoon and Sunday, when the quarry is not in operation. Collecting must be limited to a 4-hour period (8:00 a.m.-12:00 noon or 12:00



noon-4:00 p.m.), and a minimum fee of $25 must be paid to the company employee on duty. Two weeks advance notice must be given the company before collecting. Also, a release form must be signed by each collector freeing the company of liability in case of an accident. Full safety equipment must be supplied by each collector and worn into the quarry.

MINERALS

Albite (plagioclase group): massive; white; translucent; probably associated with minerals of the chlorite and vermiculite groups in pegmatites; not found in place

ANTIGORITE (serpentine group): massive; green serpentinite rock and hard fiber; var. picrolite; var. williamsite; translucent, green, cleavable nickel antigorite; translucent, purple, cleavable chromium antigorite; rare as a bright blue coating.

Apatite group(?): see fluorapatite

Aragonite: crystal tufts; usually replaced by "deweylite" or magnesite

Artinite(?): in small, clear crystal hairs, or in mats of white, satiny filaments; green crystals reported; needs verification

Aurichalcite(?): small crystalline coating

Biotite: brown flakes with, and altering to, chlorite

BRUCITE: white, pearly flakes along fractures; frequently large flakes and crystals

Brugnatellite(?)

Burkeite(?): reported as colorless to gray-white, with greenish-white fluorescence and blue phosphorescence in ultraviolet light

Cacoxenite(?): small crystal clusters; orange-brown in color

Chlorite group: see clinochlore, kämmererite

Chrysocolla(?): bluish coating

Chrysotile (serpentine group): asbestos-like; in small, cross-fiber veinlets; especially along the north wall

Clinochlore (chlorite group): crystal flakes associated with vermiculite in pegmatite dikes; var. penninite with zircon in northwest quarry wall

"DEWEYLITE": common; white, green, and brown fragments; some translucent; conchoidal fracture; quite abundant on floor of lower level, north end; white "deweylite" can be fluorescent in ultraviolet light; also, less commonly red, yellow, and blue; exact nature of "deweylite" uncertain, possibly mixture of clinochrysotile or lizardite plus stevensite (Fleischer, 1975, p. 32)

Dolomite: massive, associated with magnesite and "deweylite"; also rarely in beautiful six-sided prismatic crystals

View of main workings of Cedar Hill quarry

Epsomite(?): reported; white and powdery

Fluorapatite (apatite group)(?): small white crystals with penninite and zircon

Forsterite (olivine group): grains within serpentinite

"Garnierite": coatings; like "deweylite," exact nature uncertain, possibly a hydrated nickel silicate (Fleischer, 1975, p. 43)

Goethite: "limonite" on weathered surfaces

Heazlewoodite(?): rare, very small grains in serpentinite, not visible to the unaided eye

Hematite: coatings; also rare bloodstone

Huntite: uncommon; cryptocrystalline, white, mammillary crusts on magnesite with "deweylite"

Hydromagnesite: powdery coatings and clear, tabular to elongate crystals in sprays up to 4 inches long; possibly alteration product of brucite

Kämmererite (chlorite group): rare; reddish-violet crystal plates up to ½ inch across

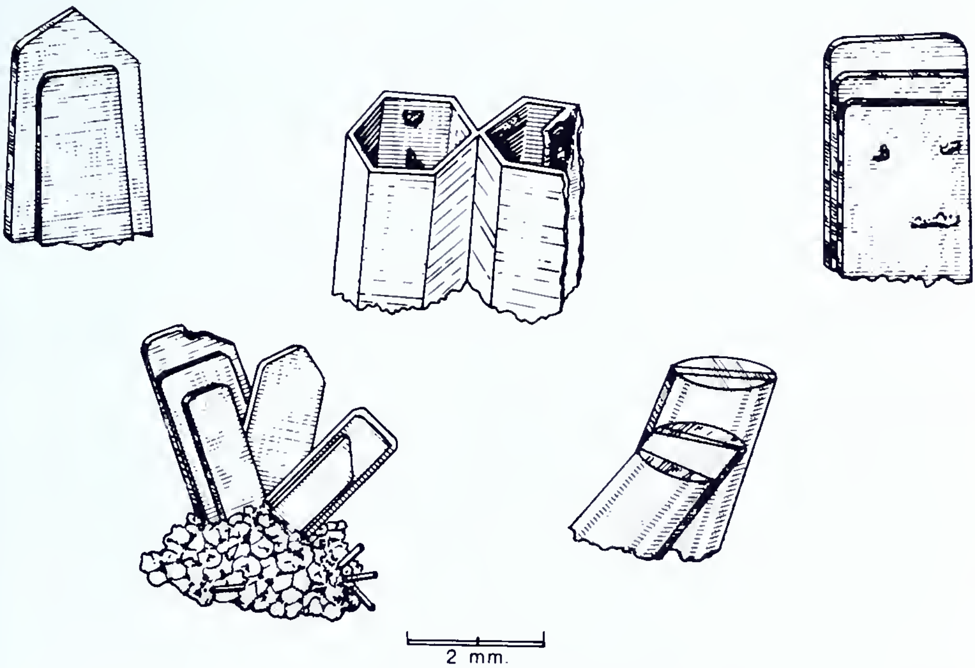
Lizardite (serpentine group): within massive serpentinite

MAGNESITE: common; white; massive, cryptocrystalline; also in globular clusters and small stalactitic pencils; rare crystals with hydromagnesite, probably scalenohedral with rounded faces and pencil shaped

Magnetite: disseminated grains in serpentinite; rarely in crystals up to ½ inch; also massive with antigorite var. picrolite along shear planes and with massive chlorite; rare crystal rhombs in chlorite-talc schist

Malachite(?): small green crystal clusters on weathered surfaces

Muscovite: colorless flakes and books in quartz-feldspar pegmatite



Pseudomorphs of deweylite after magnesite (Lapham, 1961)

Opal: usually black to brown and bladed or wedge-shaped; also white to colorless botryoidal hyalite

Olivine group: see forsterite

Pyrite: grains in serpentinite; can be confused with heazlewoodite(?)

Pyroaurite: small, silky white crystals with hydromagnesite; also pale-green crystals, "nickel pyroaurite(?)"

Pyrolusite: dendrites on fracture planes

Quartz: associated with dolomite and magnesite; chalcedony, banded and mammillary, uncommon; prase, massive, banded, botryoidal, uncommon, semiprecious quality; quartz also in pegmatite

Riebeckite(?): var. crocidolite; reported as fibrous blue coatings on fracture surfaces

Rosasite: light blue; fibrous rosettes and massive; south end of upper level

Schorl (tourmaline group): black, in quartz-feldspar pegmatite

Sepiolite(?): associated with "deweylite"

Serpentine group: see antigorite, chrysotile, lizardite

Stevensite(?): associated with "deweylite," needs verification

Talc: at north contact of serpentinite; massive and rarely as flakes; small, complex, pale green crystals very unusual

Tourmaline group: see schorl

Vermiculite group: crystal flakes in the center of pegmatites; northwest and southeast quarry walls

Zircon: uncommon; small, tan crystals; fluorescent in ultraviolet light; with penninite in northwest quarry wall

UNDEFINED COMPOUND: magnesium-nickel hydroxide; yellow to yellowish-green; hexagonal, mica-like plates or powder; related to and occuring with brucite

Additional notes: (1) zaratite, calcite, and ilmenite have been reported, but were probably incorrectly identified; (2) magnetite in crystals may be found in chlorite schist north and west of the quarry; (3) the Geiger pit, an old chromite prospect south of the quarry, contains veins of chromite; breunnerite has also been reported (see Beck, 1952).

GEOLOGY

A sequence of four events led to the abundance of interesting minerals here. The first event was the intrusion of magma with a very low silica content, probably during the early Paleozoic era. The igneous rock that formed as the magma solidified was dunite, a rock with a very high content of forsterite (olivine group) and minor amounts of pyroxene, chromite, and magnetite. The fragments of these minerals found in the serpentinite are remnants of the dunite. After the dunite had solidified, chemical alteration began to transform the minerals to compounds more stable near the surface. The principal effect of this was the alteration and hydration of the olivine to serpentine minerals, such as antigorite, transforming the dunite to massive serpentinite. The third step, that resulted in the greatest number of collectable minerals, was the intrusion of the serpentinite by hot, watery (hydrothermal) solutions, with a higher silica content than the magma of the original intrusion. This resulted in the formation of minerals directly from the solutions (such as quartz), as well as many minerals that formed as a result of chemical reactions between the solutions and the serpentinite. Most of the minerals listed probably formed in this way. The fourth step is going on today; weathering. Among minerals probably forming in this way are hydromagnesite, "limonite," and huntite.

SIMILAR OCCURRENCE

Brinton's quarry, Chester County

REFERENCES

Beck, H. H. (1952), *The minerals of Lancaster County,* Linnaean Society of Lancaster County, 3rd ed., Science Press, 13 p.

Fleischer, Michael (1975), *Glossary of mineral species,* Mineralogical Record, Inc., Bowie, Maryland, 145 p.

Lapham, D. M. (1960), *Geology of the Cedar Hill serpentinite quarry,* Guidebook, 25th Field Conf. Pa. Geologists, Pa. Geol. Survey, p. 35-38.

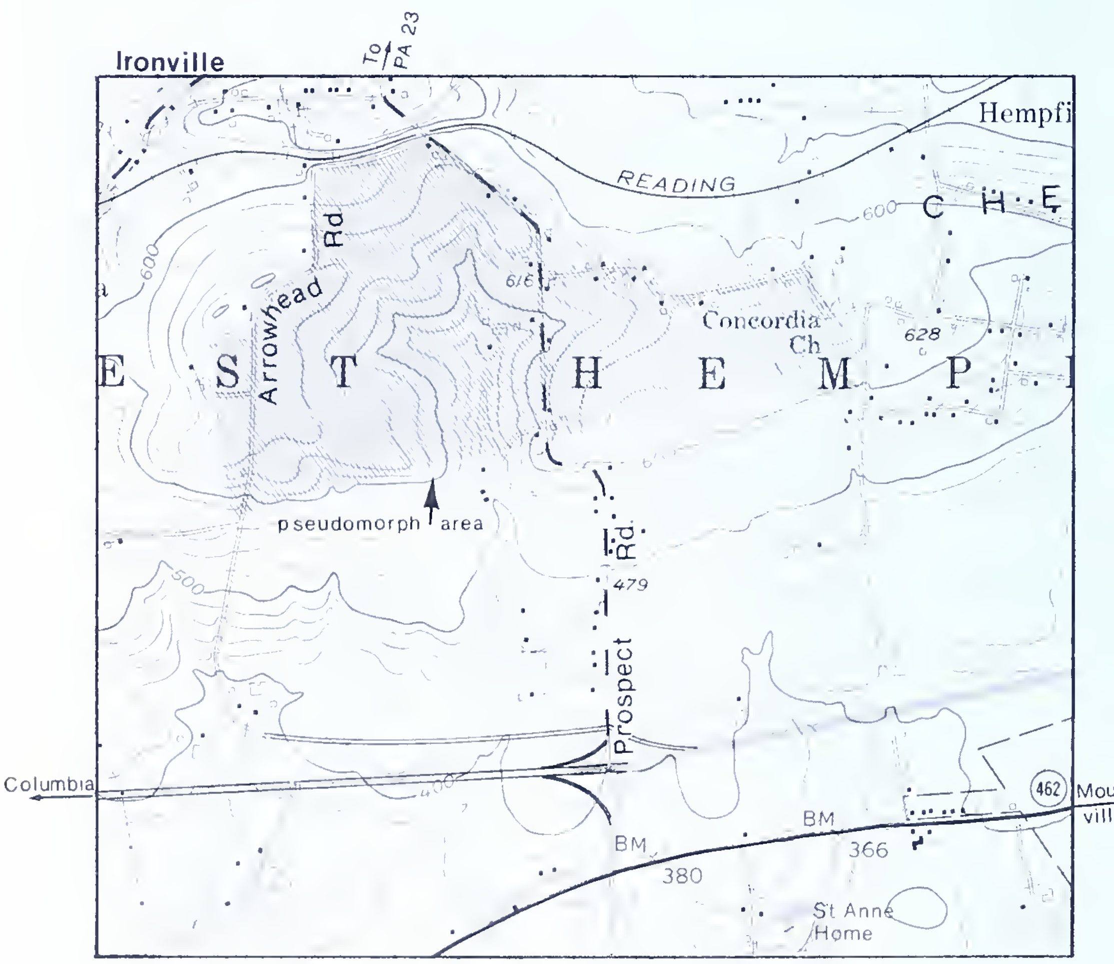
———————— (1961), *New data on deweylite,* Am. Mineralogist, v. 46, p. 168-188.

Lapham, D. M. and Barnes, J. H. (1971), *Unusual minerals found in Pennsylvania,* Pennsylvania Geology, v. 2, no. 6, p. 2-3.

CHESTNUT HILL LIMONITE PSEUDOMORPH LOCALITY

LOCATION

This "limonite" pseudomorph site is located in the Columbia East quadrangle, approximately 0.75 mile north of the Prospect Road interchange on U.S. Route 30. The pseudomorphs may be found in the fields east and west of Arrowhead Road and Prospect Road. Many different land owners are involved, and it is very important that the correct land owner be contacted in order to gain permission to collect. Unharvested corn and grain fields should never be entered. The best time to collect these pseudomorphs is during spring plowing season or late in the fall after the harvest.



"Limonite" pseudomorphs after pyrite still maintaining cubic crystal form from the Chestnut Hill area

MINERALS

GOETHITE: "limonite" pseudomorphs after pyrite; unusually fine specimens; may be large, greater than one inch on an edge; often twinned.

Hematite: with muscovite in cavities within pseudomorphs

Muscovite: in pseudomorphs and in the associated phyllite and schist

Pyrite: with goethite and rarely heulandite(?) or gypsum(?) with pseudomorphs

Quartz: in associated phyllite and schist; some milky almost opalescent; a few crystals have been found

Sulfur: rare; pale-greenish yellow; with pseudomorphs; shows orthorhombic crystal faces

GEOLOGY

The "limonite" cubes found in the fields along the south side of Chestnut Hill have weathered out of the underlying bedrock, the Cambrian Harpers phyllite. This rock unit consists of mica, clay minerals, some quartz, and feldspar. Pyrite cubes in the phyllite have been weathered (altered) to "limonite." The weathering process removes the sulfur content of the pyrite and replaces it with oxygen and hydrogen from water, changing the mineral to goethite. The original shape of the pyrite, however, has been retained, including the striations that were on the pyrite cube faces. It is for this reason that the word "pseudomorph" (from the Greek words meaning "false form") is applied. Many of the "limonite" pseudomorphs still retain some of the orginal pyrite in the center of the crystal.

SIMILAR OCCURRENCE

Fruitville Pike locality, Lancaster County

REFERENCES

Beck, H. H. (1952), *The minerals of Lancaster County,* 3rd ed., Linnaean Society of Lancaster County, Sci. Press, 13 p.

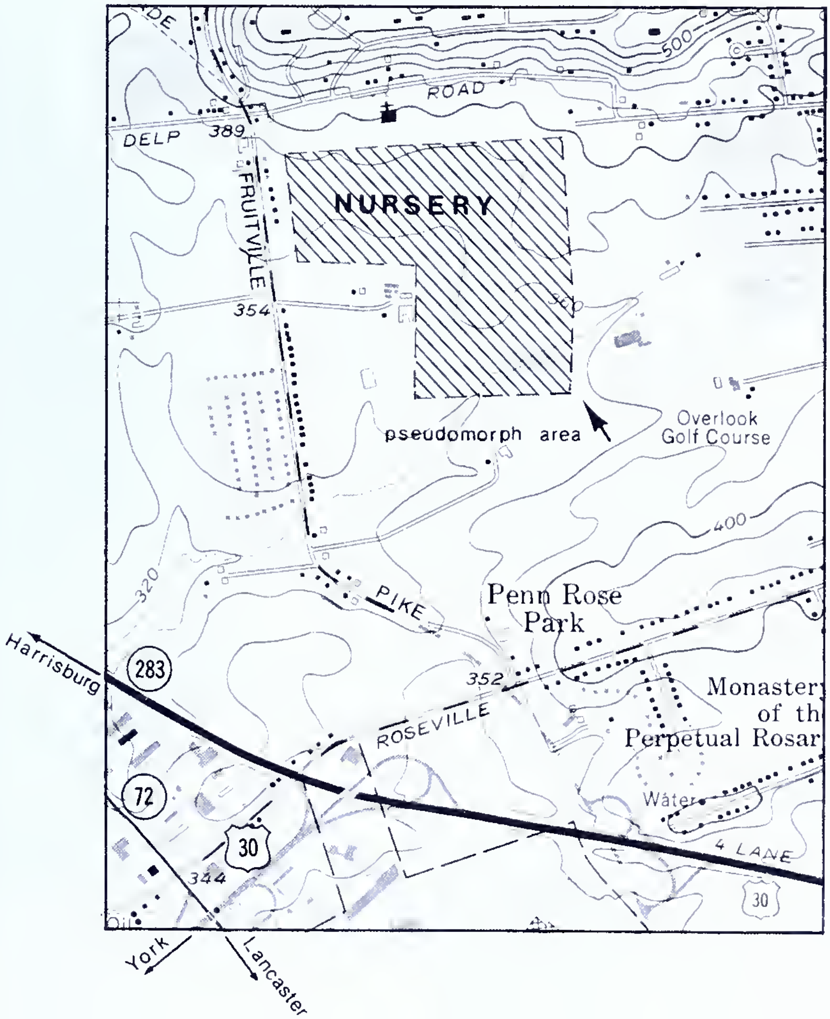
Geyer, A. R. and others (1951), *The geology of the Chestnut Hill area between U.S. 30 and Silver Springs, Lancaster County,* unpub. senior field geology thesis, Lancaster, Franklin and Marshall College.

Meisler, Harold and Becher, A. E. (1971), *Hydrogeology of the carbonate rocks of the Lancaster 15-minute quadrangle, southeastern Pennsylvania,* Pa. Geol. Survey, 4th ser., Water Resource Rept 26, 149 p.

FRUITVILLE PIKE LIMONITE PSEUDOMORPH LOCALITY

LOCATION

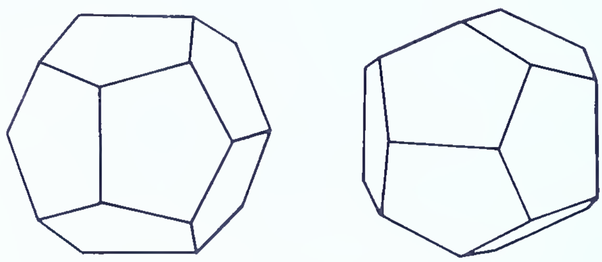
This "limonite" pseudomorph locality is found on the Lancaster quadrangle. The site encompasses a general area approximately one mile north of Lancaster and east of the Fruitville Pike; marked on the accompanying map with a line pattern. The fields in which these pseudomorphs are found are the privately owned grounds of the Schwartz Nursery and surrounding farms. Permission to collect must be obtained from the owners. Collecting is best where the fields have been plowed and where there are concentrations of loose surface materials such as erosion gullies. Fields of unharvested crops (usually wheat and corn) should never be entered.



MINERALS

GOETHITE: "limonite" pseudomorphs after pyrite; pyritohedrons are of particular interest at this locality; most specimens are small, rarely exceeding ½ inch on an edge; penetration twins have been found

Quartz: crystals are rare; clear to milky; some crystals are doubly terminated; mostly massive



pyritohedrons

GEOLOGY

The pseudomorphs (meaning "false form") occur in the Ledger Formation of Cambrian age. The main rock type here is a light-gray, coarsely crystalline, sparkling dolomite. "Limonite," a mixture of goethite and noncrystalline iron hydroxide, has replaced pre-existing cubes and pyritohedrons of pyrite.

This replacement is the result of weathering that takes place on the outside of the crystal and slowly progresses toward the center. If larger specimens are found, they may still contain unaltered pyrite in the center. The striations on the crystal faces of the original pyrite have been preserved by this replacement.

SIMILAR OCCURRENCE

Chestnut Hill, Lancaster County

REFERENCE

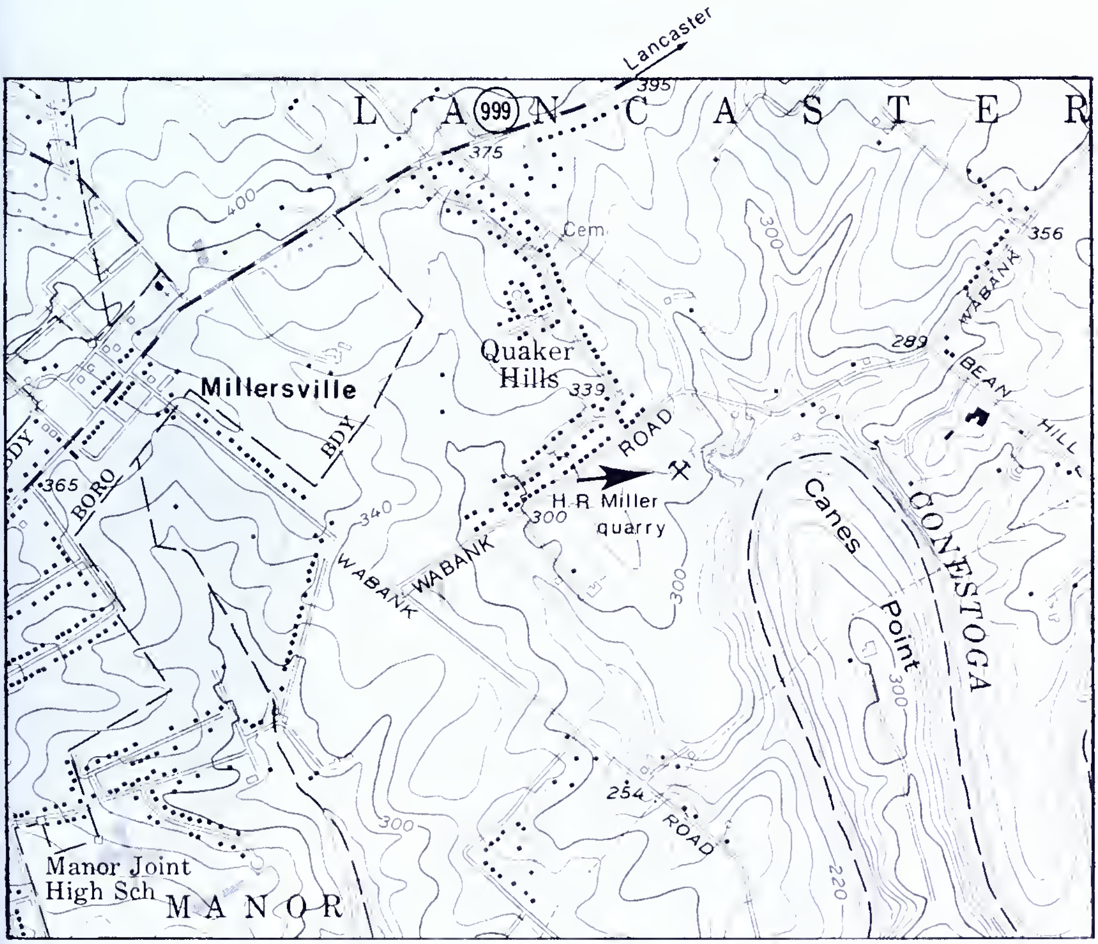
Meisler, Harold and Becher, A. E. (1971), *Hydrogeology of the carbonate rocks of the Lancaster 15-minute quadrangle, southeastern Pennsylvania*, Pa. Geol. Survey, 4th ser., Water Resource Rept. 26, 149 p.

H. R. MILLER LIMESTONE QUARRY

LOCATION

This quarry is operated by the H. R. Miller Company, which is obtaining limestone for use as crushed stone.

The quarry is located on Wabank Road in Lancaster Township along Conestoga Creek approximately 1 mile from the intersection of Wabank Road and Pa. Route 999 in Millersville. Note that there are two roads named "Wabank" that intersect near an elementary school just southeast of Millersville. Coming from Millersville, take the "Wabank Road" to the left at the school. The quarry is on the Lancaster topographic map. This is an active quarry. Permission to collect



must be obtained at the office before entering the quarry, and a release form must be signed. Collectors should confine their activities to evenings and weekends, when the quarry is not operating.

MINERALS

As in most limestone quarries, the minerals that may be found are dependent on blasting that might expose vugs or filled fractures within the limestone. As a result, both the quality and quantity of minerals to be found at any one time varies considerably.

CALCITE: excellent crystals up to 4½ inches in length; crystals occur as scalenohedrons, positive and negative rhombs, and nailhead crystals (hexagonal crystals with flat rhombohedron terminations); early formed crystals are frequently translucent to transparent, and often contain small inclusions of pyrite, hematite, mica, and small unidentified needles; crystals formed later are white, nearly opaque, and occasionally fluorescent in ultraviolet light; phantom growths and etched faces have been observed

Chalcopyrite: very small crystals

Dolomite: occurs as pink rhombs on dolomitic limestone; frequently coated with "limonite," resembling siderite

Fluorite: purple; in masses up to 3 inches across, or small cleavage fragments

Goethite: as "limonite;" poor quality pseudomorphs after pyrite; near fractures

Hematite: inclusions in calcite; coatings

Malachite: green stains

Mica group: species unknown; as thin layers of small, brown flakes in phyllitic rock; also as inclusions in calcite

PYRITE: common as cubes; rarely up to ½ inch; also in unusual columnar crystals of stacked cubes that resemble rather thick needles.

Pyrolusite: uncommon; excellent dendrites on calcite

GEOLOGY

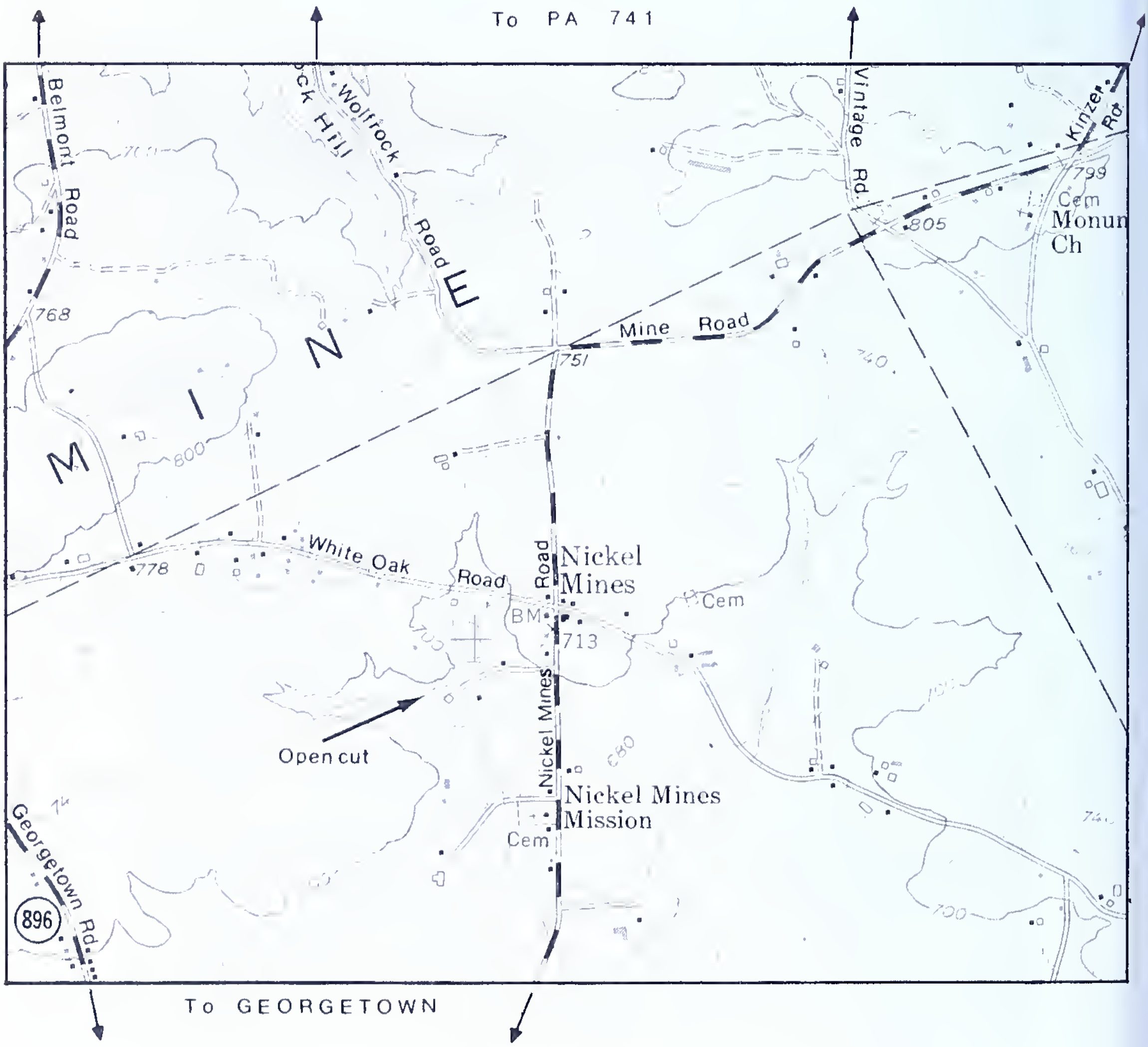
Most of the above minerals formed in vugs and fractures in the limestone of the Ordovician Conestoga Formation. The mica, pyrite, chalcopyrite, and malachite formed in phyllite, a mica-rich rock formed from shale by mild metamorphism, and probably originated from minerals initially present in the shale. The calcite and dolomite crystals formed as a result of solution of the limestone by ground water, followed by re-crystallization of the calcite and dolomite as crystals. The presence of phantom crystals and several different generations of crystal growth indicates that more than one such cycle occurred, separated by some time interval.

NOTES

GAP NICKEL-COPPER-COBALT MINE

LOCATION

The Gap nickel mine is located 1250 feet (0.25 mile) southwest of the village of Nickel Mines in Bart Township on the Gap quadrangle. The open cut shows a small depression on the topographic map. The area can be entered from a west-trending private farm lane which leaves Nickel Mines Road about 500 (0.1 mile) feet south of Nickel Mines. Best collecting is on the dumps to the southeast of the open cut. Permission to collect must be obtained from the owners of this property.



View of Gap nickel mine dumps today

MINERALS

Aragonite: needles and radiating sprays; sometimes green from traces of copper or nickel, rare
Arsenopyrite(?): reported
Biotite
Chalcanthite
Chalcocite
CHALCOPYRITE: golden-yellow blebs in hornblende rock
Copiapite
Copper
Cubanite(?): not reported, but probably present as magnetic, brass-yellow grains
Hisingerite(?): black
Hornblende: dark-green to black grains composing the host rock
Jarosite: buff coatings on weathered ore
Magnetite(?): not reported but probably present
Marcasite(?)

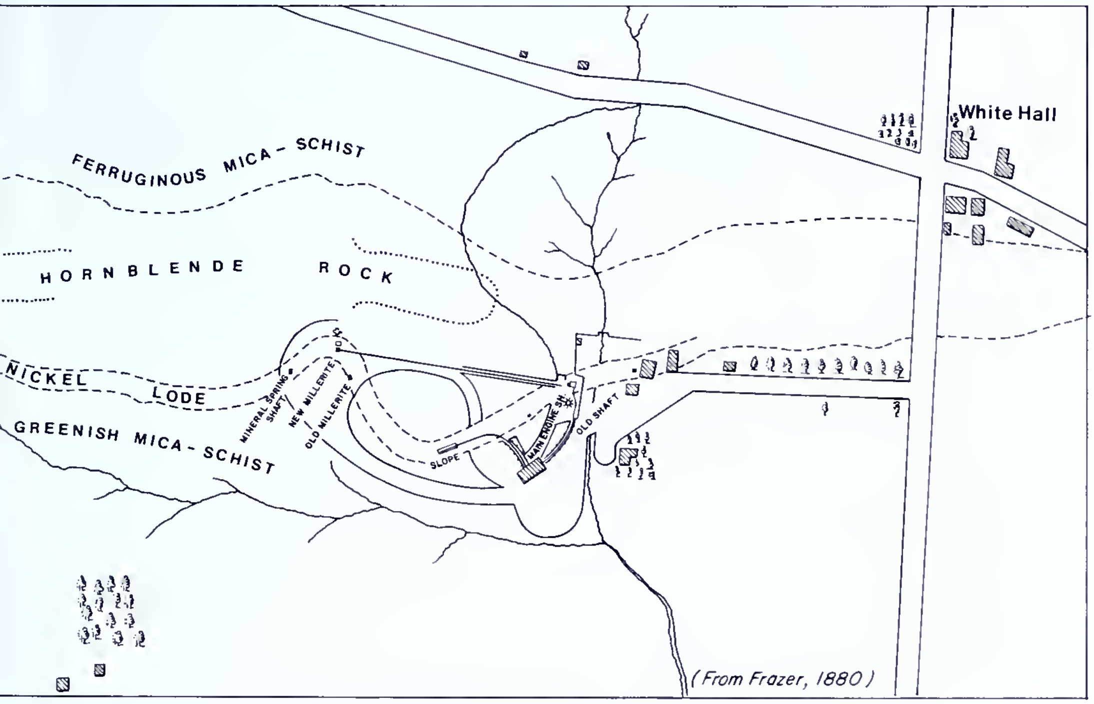
Looking east toward open cut on south side of the Gap mine — April 1894

Melanterite: white, powdery coatings on weathered ore; probably accumulates during dry weather
Millerite: plates of fibrous crystals; rare on the dumps because of weathering
Morenosite: rare; apple-green microcrystals on millerite; dehydrates to retgersite on the dumps
PENTLANDITE: common; bronze-yellow blebs which are nonmagnetic; alters readily
Pyrite
PYRRHOTITE: very common; bronze to brown, slightly magnetic masses
Retgersite: emerald to blue-green microcrystals on millerite; rare on dumps
Rozenite: white powder
Scorodite
Siderite
Violarite: metallic; violet gray, cracked veinlets, between pyrrhotite and pentlandite
Vivianite: rare; dark-blue microcrystals in quartz veins

GEOLOGY

The Gap mine is a minature Sudbury (Ontario) – type ore deposit. Such deposits formed at the base of gabbro igneous intrusions which were rich in sulfur, nickel, and copper. After intrusion into their present position, heavy, insoluble iron-nickel-copper sulfide globules settled out from the still-molten magma resulting in the accumulation of a sulfide layer at the base of the intrusion. Above this layer, leaner ore, consisting of scattered metallic-rich globules intermixed with the rock-forming minerals and crystallized. There are also indications of mineral deposition in fractures within the igneous rock from late-stage hydrothermal solutions.

Copper was recognized in spring water as early as 1718. Serious attempts were made to mine copper in 1849 but the operation failed. In 1852 Friedrich August Ludwig Karl Wilhelm Genth correctly identified nickel in the pyrrhotite ore. Under Joseph Wharton's ownership, Captain Charles A. Doble produced about seven million dollars worth of nickel between 1863 and 1893.



GEOLOGY OF THE GAP NICKEL MINE AREA

View of Gap mine from the east — April 1894

REFERENCES

Frazer, Persifor (1880), *The geology of Lancaster County*, Pa. Geol. Survey, 2nd ser., Rept. CCC, p. 163-176.

Kemp, J. F. (1894), *The nickel mine at Lancaster Gap, Pennsylvania*, Trans. Am. Inst. Mining Eng., v. 24, p. 620-633.

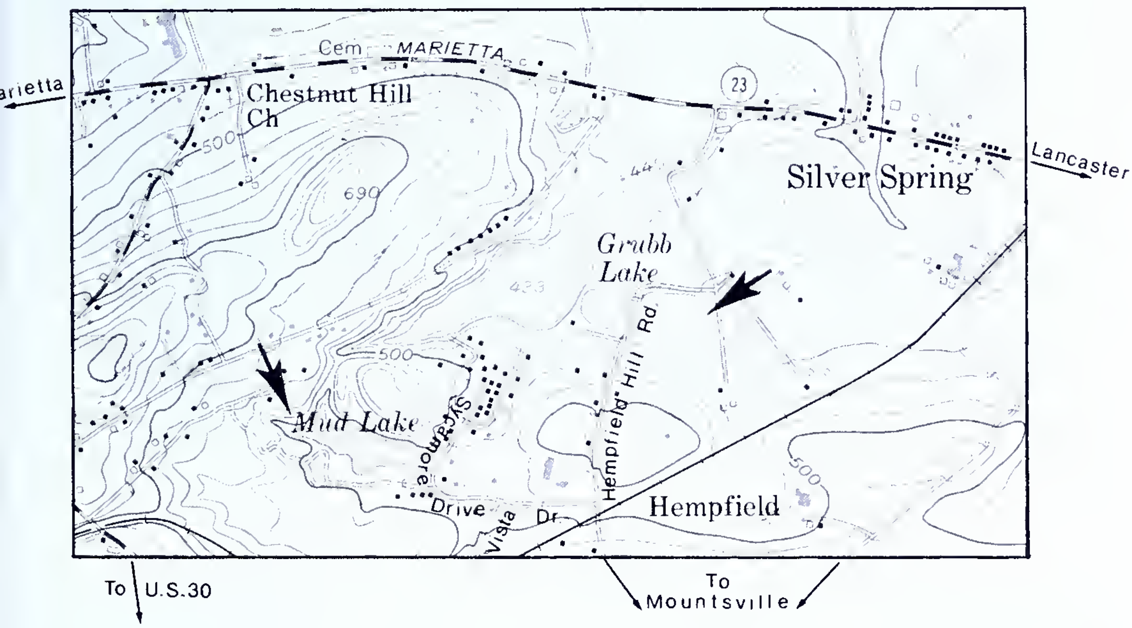
Speer, J. A. and Martin, E. C. (1974), *Violarite from the Gap Nickel Mine*, Mineralogical Record, v. 5, no. 4, p. 209-210.

NOTES

MUD LAKE GOETHITE LOCALITY

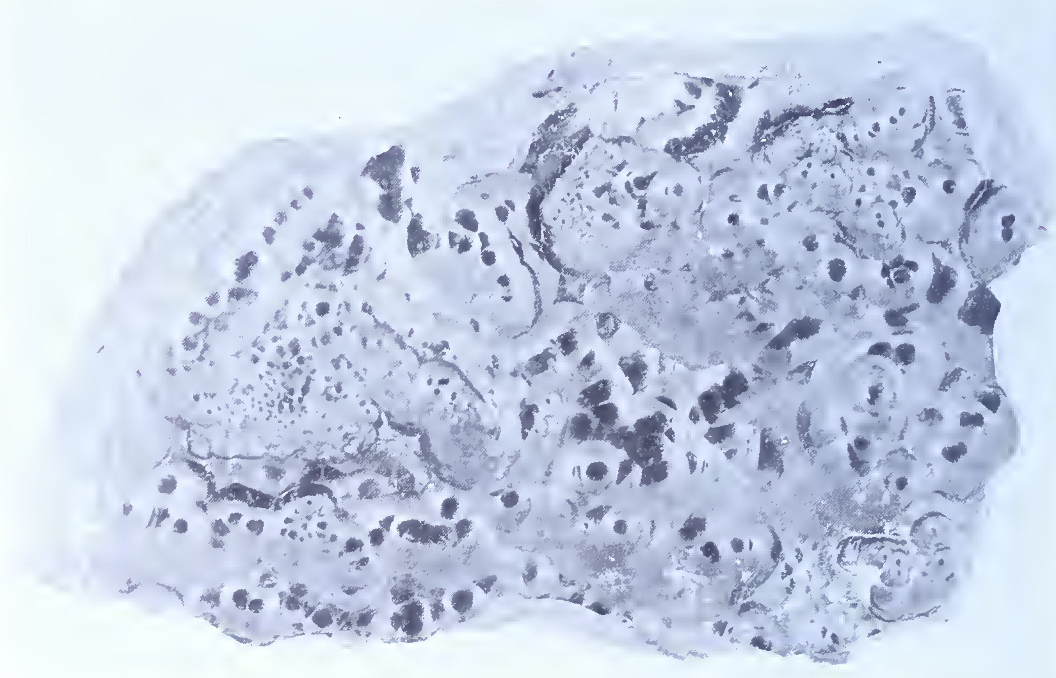
LOCATION

The Mud Lake area, about one mile to the northeast of the Chestnut Hill "limonite" pseudomorph locality and about a mile southwest of the village of Silver Spring, is in West Hempfield Township, Columbia East quadrangle. One site is along Hempfield Road between Silver Spring and Mud Lake while the other is at Mud Lake itself. These areas provide good collecting for goethite as massive "limonite," and "geodes" or "bombs." A small ravine leading west from the west end of Mud Lake is the best area to collect "bombs." The "geodes" weather out or may be dug from the clay walls of the ravine. These sites are private property and permission to collect must be obtained.



MINERALS

Cryptomelane(?)
GOETHITE: "bombs," "geodes"; massive "limonite"
Hematite: var. specularite with magnetite
Kaolinite
Lepidocrocite: reddish crystals and crusts in cavities; layers associated with goethite
Magnetite: small octahedral crystals with hematite and clay
Pyrolusite
Quartz: massive and small crystals



Hand specimen of goethite from Mud Lake area

GEOLOGY

The regional geologic setting is within a zone of thrust sheets between U. S. Route 30 and Pa. Route 23. Each thrust sheet usually is composed of the Cambrian Chickies quartzite, the Harpers phyllite, and the Antietam quartzite. The Mud Lake ore deposit probably represents the location of iron mineralization along one or more of these thrusts with later ore enrichment by low-temperature groundwater solutions. Complex folding of the sheets has complicated the geologic setting.

REFERENCES

Frazer, Persifor (1880), *The geology of Lancaster County,* Pa. Geol. Survey, 2nd ser., Rept. CCC, 350 p.

Meisler, Harold and Becher, A. E. (1971), *Hydrogeology of the carbonate rocks of the Lancaster 15-minute quadrangle, southeastern Pennsylvania,* Pa. Geol. Survey, 4th ser., Water Resources Rept. 26, 149 p.

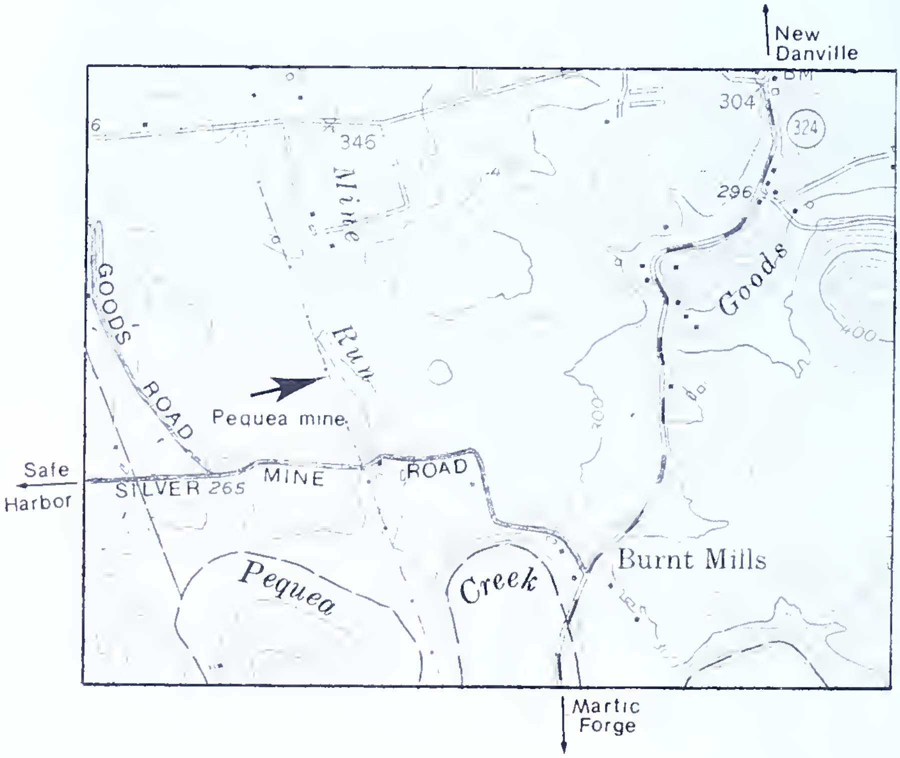
Mud Lake with arrow pointing to the ravine at the west end

PEQUEA SILVER MINE

LOCATION

The Pequea Silver mine is located approximately 3.5 miles south of the city of Lancaster in the Conestoga quadrangle. Follow Pa. Route 324 (New Danville Pike) south from Lancaster. In the village of New Danville, Pa. Route 324 is the Martinville Road. Immediately before crossing a bridge over Pequea Creek, turn west onto Silver Mine Road. Proceed over a hill, cross a wooden bridge over Silver Mine Run and park in the parking area beside the creek. The entrance to the main Pequea Silver Mine is located along a path on the west side of Silver Mine Run about 600 feet from the parking lot.

The silver mine property is known as Silver Ford, Inc. and is owned and operated by Mr. James R. Bunting. Mineral collecting, a tour of the mine, and the use of all facilities are available on a fee basis. All arrangements may be made by writing P.O. Box 1137, Lancaster, Pennsylvania 17604.



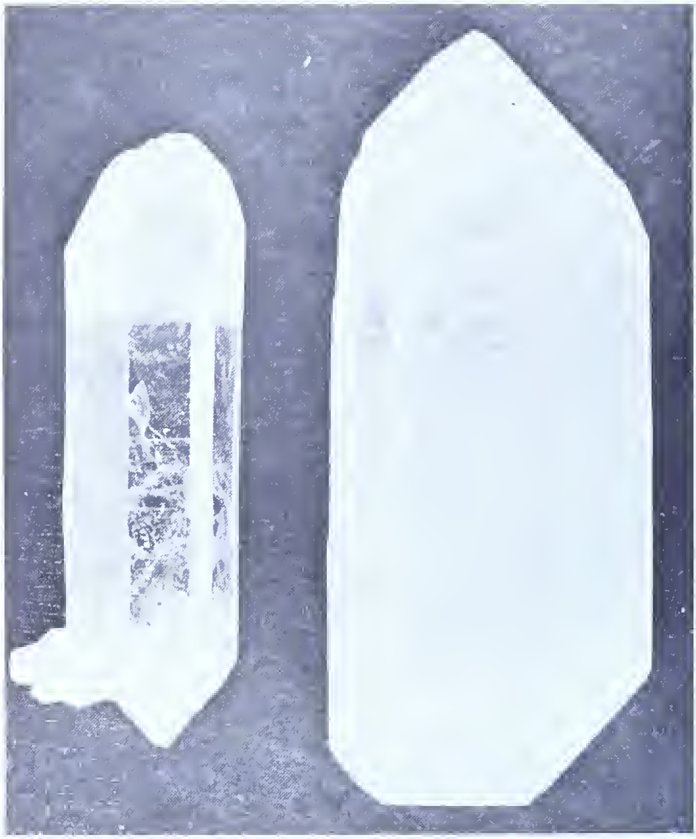
Documented evidence exists showing that the mine and surrounding pits were worked sporadically since 1709. In addition, there is some indication that lead from this locality was extracted long before that time. Lead smoking pipes taken from the graves of Indians located south of Washington Boro, only eight miles from the area, were analyzed and found to contain the exact amount of silver as the ore from the Pequea mine. During the Civil War the mines were operated for silver and lead.

MINERALS

Adularia
Anglesite: gray rims on galena
Calcite: massive; cleavages; white
Cerussite: rare; small crystals
Chalcopyrite: rare; small crystals
Galena: cubic and octahedral cleavages; contains silver which is not visible
Monazite(?): rare; golden-brown microcrystals
Muscovite: pale-green cleavages
Pyrite: cubes in black phyllite

Entrance to Pequea silver mine — 1975

QUARTZ: massive; crystals; milky to clear, flattened to tabular crystals
Rutile: dark, reddish-brown prisms
Sphalerite: rare

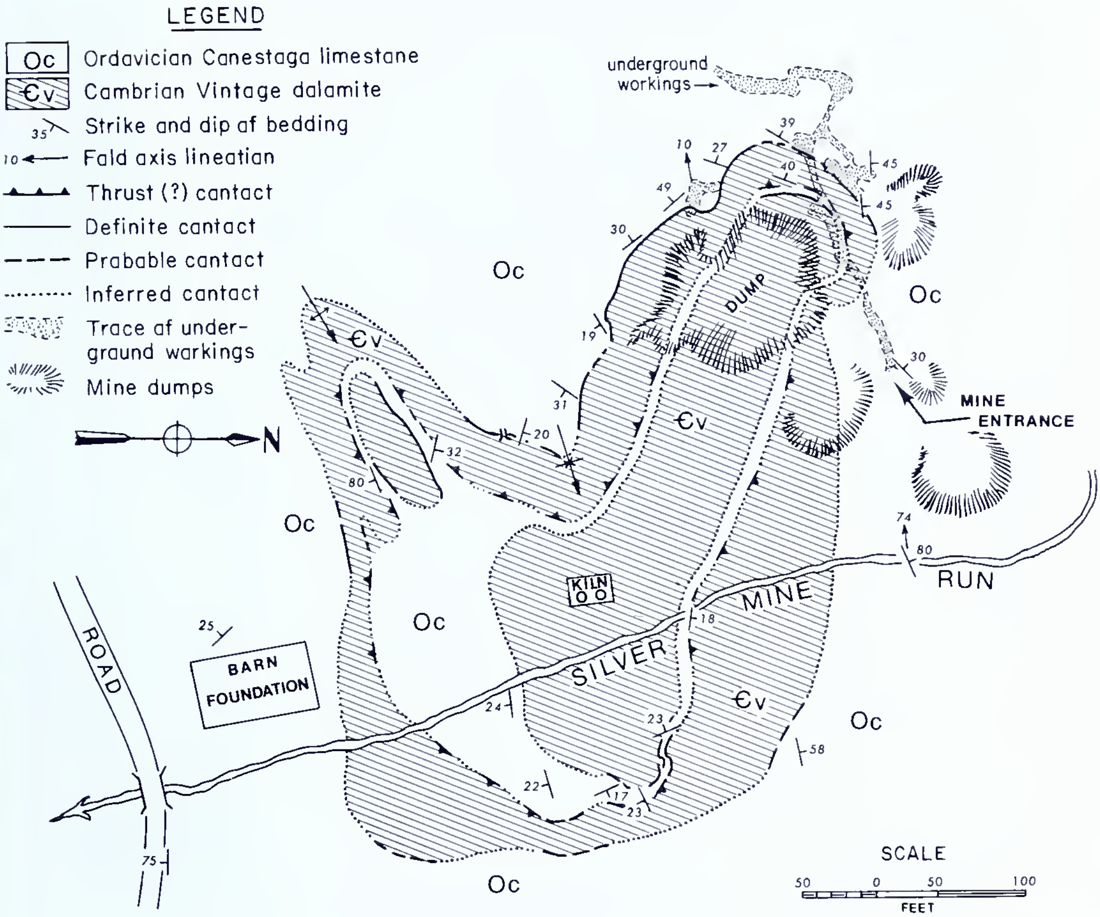


Three-inch long quartz crystals from the fields near the silver mine

GEOLOGY

The regional geologic setting of the mine is within a possible zone of thrust faults (Wise, 1960). Each fault slice is composed of the Cambrian Antietam quartzite, Vintage dolomite and the Conestoga limestone. The silver-bearing galena in quartz is concentrated at the contact of the light-gray dolomitic marble (Vintage Fm.) with the black phyllite (Conestoga Fm.). The brittle character of the Vintage dolomite may have allowed the entry of metal-bearing hydrothermal solutions of unknown origin.

GEOLOGY OF THE PEQUA "SILVER" MINE AREA



Geology by D. U. Wise and taken from Fig. 4, Wise (1960).

REFERENCES

Foose, R. M. (1947), *Geologic notes on the Pequea Silver Mine, Lancaster County, Pennsylvania,* Pa. Acad. Sci. Proc., v. 21, p. 58-63.

Freedman, Jacob (1972), *Geochemical prospecting for zinc, lead, copper, and silver, Lancaster Valley, southeastern Pennsylvania,* U.S. Geol. Survey Bull. 1314-C, 49 p.

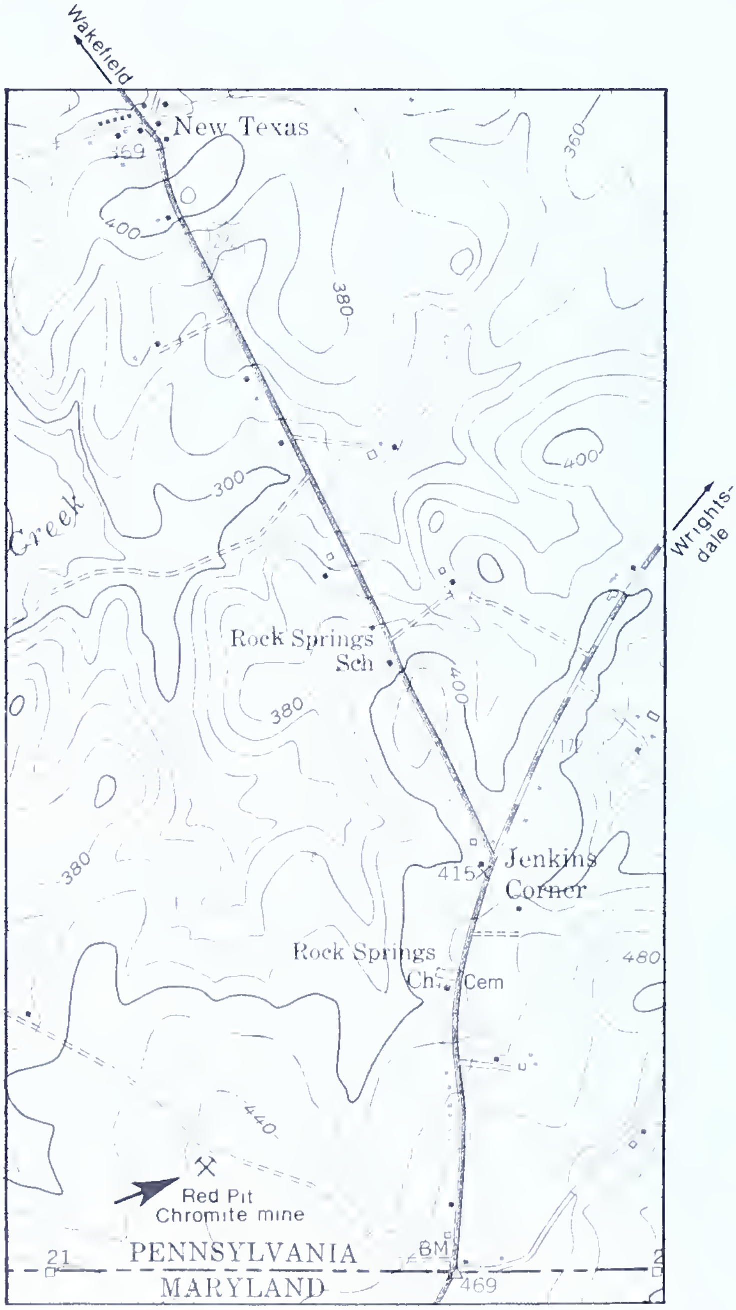
Price, J. W. (1947), *A brief history of the Pequea Silver Mine, Lancaster County, Pennsylvania,* Pa. Acad. Sci. Proc., v. 21, p. 53-57.

Wise, D. U. (1960), *The Pequea "silver" mine in some tectonic and structural problems of the Appalachian piedmont along the Susquehanna River,* Guidebook, 25th Field Conf. Pa. Geologists, Pa. Geol. Survey, p. 53-59.

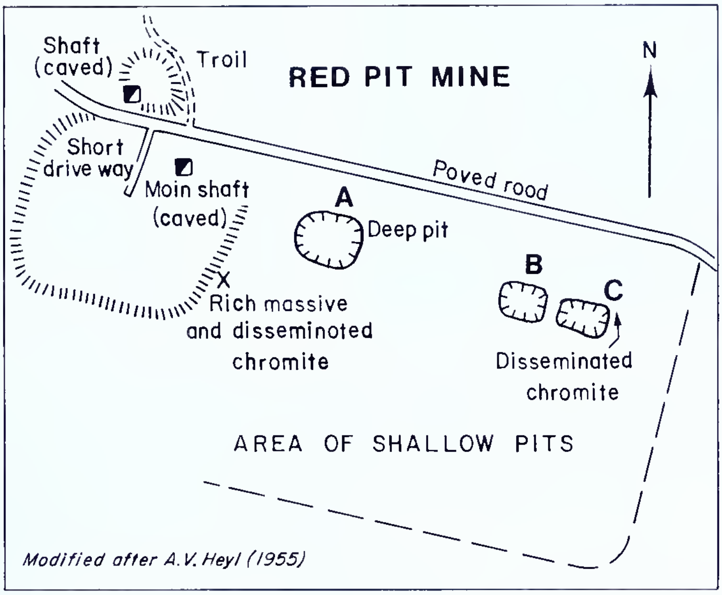
RED PIT CHROMITE MINE

LOCATION

The Red Pit mine shafts and dumps are located in southern Lancaster County in Fulton Township on the Conowingo Dam quadrangle. Immediately north of the Pennsylvania-Maryland boundary, turn west from U.S. Route 222 onto a paved secondary road. The Red Pit mine is approximately



2500 feet (0.43 mile) west from the intersection; adjacent to the road on the south side. This is private property and permission to enter must be obtained from the owner. Early spring or late fall is the best time of year to collect. The undergrowth during the summer months is too dense and the snakes too numerous.



MINERALS

Amphibole group: species unknown; asbestos-like fibers; in veins

ANTIGORITE (serpentine group): var. williamsite; bright green hard-fiber picrolite

CHROMITE: individual grains; massive in veins, stringers and lenses

"Genthite" (pimelite)(?): green stains; exact nature uncertain

Magnesiochromite (?): black; submetallic

Magnetite: lustrous; isolated grains in red siliceous float

Quartz: var. chalcedony; banded; cream to red-brown

Serpentine group: species unknown; massive, medium to dark-green blocks; also see antigorite

Zaratite: emerald-green coatings on chromite

GEOLOGY

Olivine-rich magma was intruded into schists of the Lower Paleozoic Peters Creek Formation. The chromite was proba-

Shallow depression, location B, in the Red Pit area

bly one of the early minerals to crystallize from this magma. This rock was then hydrated to serpentinite and some new minerals formed. Still later, ground water solutions formed chalcedony and weathering formed minerals such as zaratite.

Both massive and richly disseminated chromite remain on the dumps; however, disseminated chromite is more abundant. Red siliceous boxwork-like rock is abundant, probably giving the Red Pit its name.

The Red Pit mine was reportedly closed in 1868 because of an explosion on the 400-foot level. The mine is reported to have been at least 500 feet deep and to have produced thousands of tons of ore that ran greater than 50% chromium oxide. The Red Pit was almost as large a producer as the Wood mine. After the explosion, all records of the mine were lost and no attempt to reopen it has been recorded.

SIMILAR OCCURRENCES

Wood mine, Line Pit, Texas mine and the Rock Springs mine, Lancaster County

REFERENCE

Pearre, Nancy and Heyl, Allen (1960), *Chromite and other mineral deposits in serpentine rocks of the Piedmont Upland, Pennsylvania, Maryland and Delaware*, U.S. Geol. Survey Bull. 1082-K, 126 p.

WOOD CHROMITE MINE

LOCATION

The Wood chromite mine shafts and dumps are approximately 3 miles east of U.S. Route 222 and 3500 feet (0.7 mile) north of the Mason-Dixon Line (the boundary between Pennsylvania and Maryland) in Little Britain Township. A quarry symbol in a meander (bend) of Octoraro Creek, Rising Sun quadrangle, marks the location of a small quarry near the mine openings. The largest of the mine openings is water filled; a deep pit with almost vertical walls. Permission to collect must be obtained from the owner.

The scenery in the vicinity of the chromite mines is very different from the surrounding countryside. This area is locally called the "serpentine barrens" or "the Barrens" from the name of the bedrock, serpentine, and the fact that the area is wild, desolate, and uncultivated. This bedrock supports practically no vegetation except coarse grasses, scrub pine, cedars, and greenbrier.

MINERALS

ANTIGORITE (serpentine group): var. williamsite, hard-fiber picrolite, and red to purplish-red chrome-antigorite

Aragonite: rare; small crystal tufts and needles

Brookite(?): rare

Brucite: crystals on fractures; usually on serpentinite but rarely on chromite

Cacoxenite(?): rare; radiating needles

Calcite: white; small masses

Chalcocite(?): rare

Chlorite group: see clinochlore, kämmererite

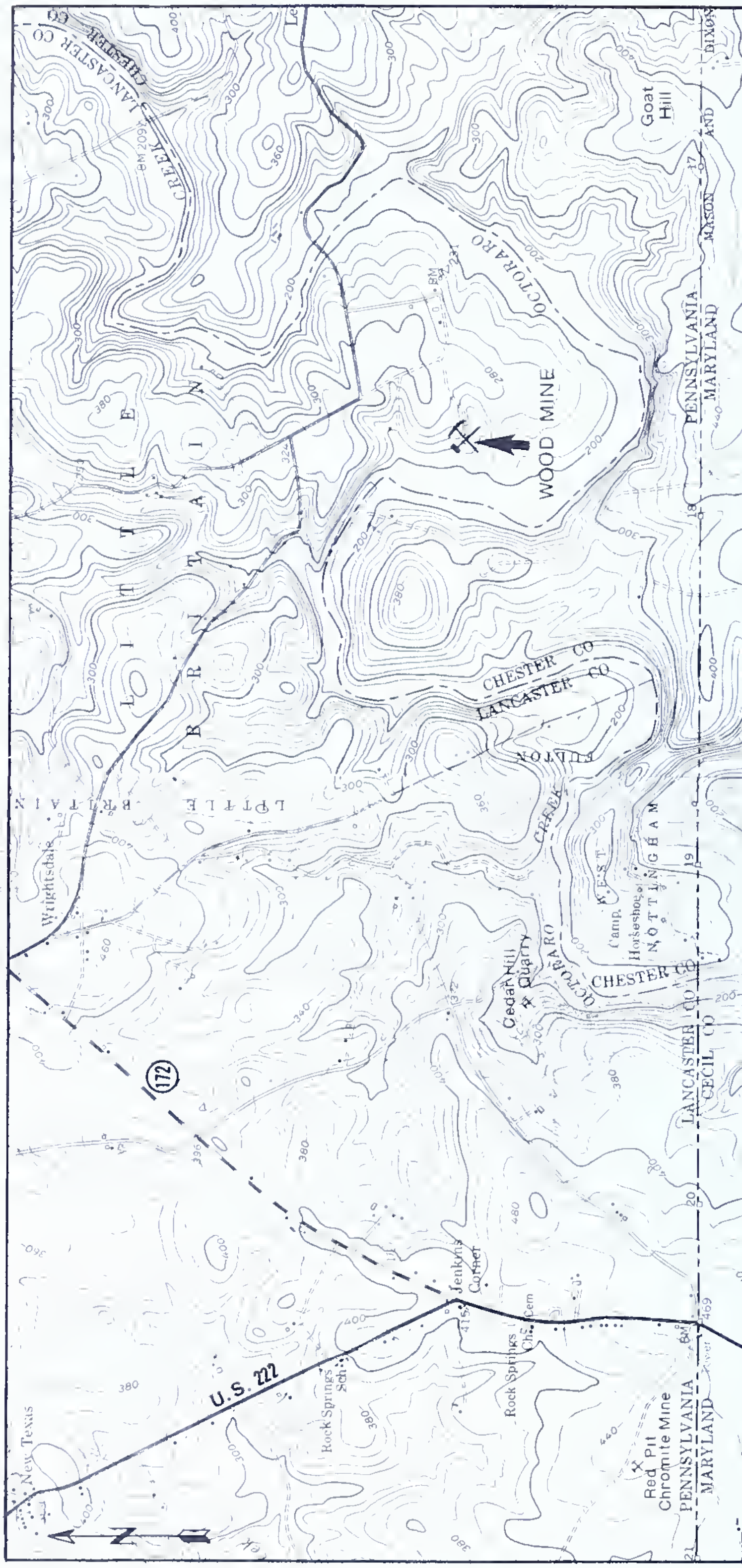
CHROMITE: massive; isolated grains in serpentinite (disseminated)

Chrysotile (serpentine group): rare

Clinochlore (chlorite group): green crystals; also var. penninite

"Deweylite": tan-colored

Dolomite: mixed with "deweylite" and magnesite; rarely in prismatic crystals


WOOD MINE
OCTORARO
LANCASTER CO
CHESTER CO
LITTLE BRITAIN
FULTON
Wrightsdale
172
U.S. 222
Jenkins Corner
Rock Springs Sch
Rock Springs Ch
Cedar Hill Quarry
Camp Horseshoe
WEST NOTTINGHAM
Goat Hill
MASON AND DIXON
PENNSYLVANIA
MARYLAND
CECIL CO
Red Pit Chromite Mine
New Texas

Garnet group: see grossular, uvarovite
"Garnierite"(?): green coating
Grossular (garnet group): green
Hematite: coating
Hydromagnesite: crusts and crystals on serpentinite; with magnesite and brucite
Ilmenite(?): rare
KÄMMERERITE (chlorite group): common; crystal flakes of red to purple on chromite
Magnesite: massive; found in quarry face in bands; stalactitic and globular crusts are rare
Magnetite: massive and in isolated grains
Millerite(?): rare; needles reported
Pyrite: rare; small cubes
Pyroaurite: rare; brownish-orange, hexagonal crystals associated with magnesite
Quartz: var. chalcedony; banded
Uvarovite (garnet group): green
Vermiculite group: lighter green than chlorite; some silvery or brownish green
Vesuvianite (idocrase) (?): rare
Zaratite: emerald-green coatings on chromite

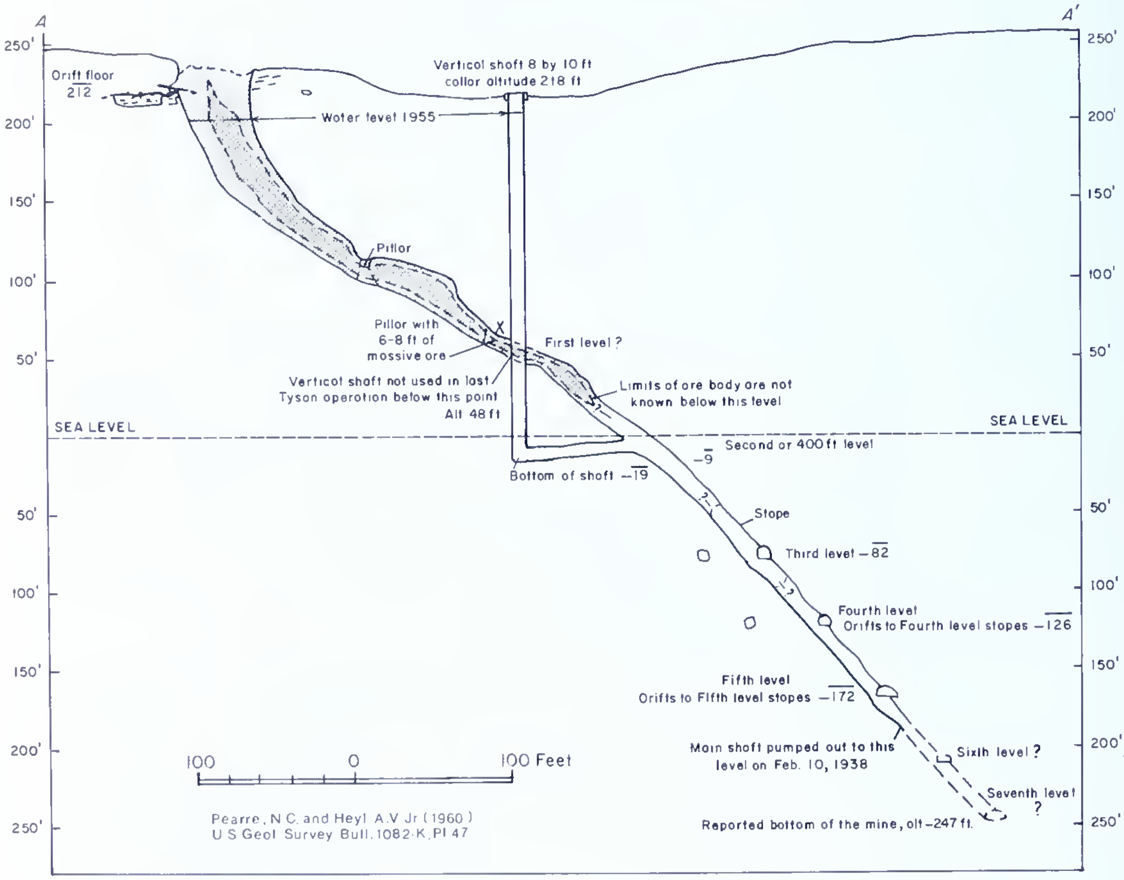
GEOLOGY

The great variety of minerals at the Wood mine is the result of a complex geologic history. A lens-shaped igneous intrusion entered the Lower Paleozoic Peters Creek schist to form a rock composed of forsterite (olivine group), which was then hydrated to serpentinite. The chromite was probably an early crystallizing mineral from the dunite magma. The chromite survived the hydration process.

At the time of alteration of the forsterite rock to serpentinite, new minerals were formed: magnetite, chrome-antigorite, and kämmererite. Later solutions formed chlorite-vermiculite, clinochlore and pyrite. Weathering and ground water solution and deposition (low temperature) resulted in the formation of magnesite, hydromagnesite, calcite, chalcedony, aragonite, "deweylite", "genthite", brucite, and zaratite along fractures and in vugs within the serpentinite bedrock.

The Wood mine was the largest and most famous of the chromite mines in Pennsylvania. From 1828 until 1880 a steady production of chromite ore was shipped from the mine. Immediately after the Civil War, the output of the mine decreased from about 500 tons a month to less than 600 tons per year. By 1867, the deep ore was reportedly exhausted and only the upper part of the mine was worked. There is some question whether more ore could be present at depth below the old mine. A total production figure of about 96,000 tons of chromite ore is reported from this one mine. The Wood mine remained open until 1882 but only 300 tons were extracted during the interval from 1880 to 1882.

CROSS SECTION OF THE WOOD CHROMITE MINE



SIMILAR OCCURRENCES

Red Pit mine, Line Pit, Texas Mine and the Rock Springs mine, Lancaster County

REFERENCES

Beck, H. H. (1952), *The minerals of Lancaster County,* 3rd ed., Linnaean Society of Lancaster County, Sci. Press, 13 p.

Duersmith, L. J. (1951), *Wood's chrome mine, Lancaster County, Pennsylvania,* Rocks and Minerals, v. 26, no. 5-6, p. 243-247.

Genth, F. A. (1875), *Preliminary report on the mineralogy of Pennsylvania,* Pa. Geol. Survey, 2nd ser., Report B, 206 p.

Glass J. J. and others (1959), *Chromium antigorite from the Wood Mine, Lancaster County, Pennsylvania,* Am. Mineralogist, v. 44, p. 651-656.

Gordon, S. G. (1922), *The mineralogy of Pennsylvania,* Phila. Acad. Nat. Sci., Spec. Rept. 1, reprinted 1973 by Region 3, Friends of Mineralogy, p. 205-206.

Lapham, D. M. (1958), *Preliminary report on the chromite occurrence at the Wood Mine, Pennsylvania,* Pa. Geol. Survey, 4th ser., Prog. Rept. 153, 11 p.

Pearre, Nancy and Heyl, Allen (1959), *The history of chromite mining in Pennsylvania and Maryland,* Pa. Geol. Survey, 4th ser., Inf. Circ. 14, 27 p.

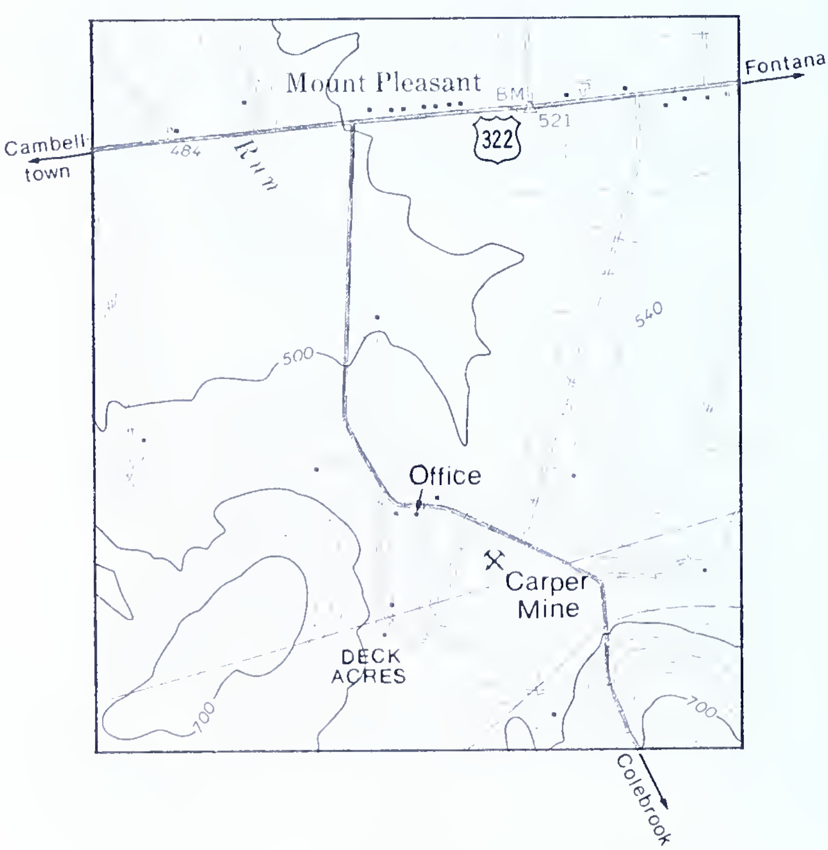
__________ (1960), *Chromite and other mineral deposits in serpentine rocks of the Piedmont Upland, Pennsylvania, Maryland and Delaware,* U.S. Geol. Survey Bull. 1082-K, 126 p.

NOTES

CARPER MAGNETITE MINE

LOCATION

This is the site of Deck Acres campground, located in South Annville Township about 0.8 mile southeast of Mt. Pleasant and U.S. Route 322 (Palmyra quadrangle). The old open pit and mine workings are about 900 feet (0.18 mile) east of the campground office. Collecting is best along the north wall of the enlarged pit area. Campers should seek permission to collect.



Area of the Carper mine

MINERALS

Calcite: small patches, pods; white
Chalcopyrite: massive; small amounts
Garnet group: species unknown; ruby red; granular
Goethite: massive "limonite"; coatings
Hematite: specular
Magnetite: octahedrons; platy; disseminated
Malachite: coatings; botryoidal; fibrous, silky
Pyrite: small masses
Quartz: massive; small blebs; crystals in veins

GEOLOGY

The geology of the Carper mine is complex. The ore is enclosed entirely in a poorly understood sequence of contact metamorphosed shales and conglomerates (the Ordovician(?) Mill Hill slate and blue conglomerate) similar to those exposed at the Cornwall mines. To the north of these slates, limestone and dolomite of the Buffalo Springs Formation of Cambrian age crop out and to the south lies an igneous intrusion of Triassic diabase. Unlike the main ore bodies at

Cornwall, the Carper ore appears to be a replacement of shales and conglomerates rather than limestone. The ore-forming solutions probably came from diabase intrusives, exposed to the south of the mine.

The ore zone was exposed for 600 feet or more at the surface. To the west it has been cut off by a fault and to the east it appears to have been eroded. The ore zone as well as the enclosing shales and conglomerates dip about 50° south. The ore was reported to be up to eight feet thick. The entire ore zone would be visible today along the north wall and in the bottom of the pit if some minor cover were removed.

During the mid to late 1800's this magnetite deposit was worked along its outcrop and by a shaft 25 feet deep. It has been reported that 1500 tons of ore were removed. In those days, it was common practice to drive a horizontal tunnel into the ore as well as a vertical shaft to meet the tunnel. This tunnel probably intersected the ore vein at about 25 feet below the surface and represented the deepest this mine was operated. The shaft was used to haul the ore to the surface whereas the tunnel provided an easy access for removal of the host rock and water drainage. The remains of this tunnel can still be seen.

SIMILAR OCCURRENCES

Cornwall mines, Lebanon County; Jones mine, Berks County; French Creek mine, Chester County; Dillsburg mines, York County

REFERENCES

Geyer, A. R. (1970), *Geology, mineral resources and the environmental geology of the Palmyra quadrangle, Lebanon and Dauphin Counties,* Pa. Geol. Survey, 4th ser., Atlas 157d, 46p.

Lesley, J. P. and D'Invilliers, E. V. (1885), *Report on the Cornwall iron ore mines,* Pa. Geol. Survey, 2nd ser., Annual Rept., p. 491-570.

Spencer, A. C. (1908), *Magnetite deposits of the Cornwall type in Pennsylvania,* U.S. Geol. Survey Bull. 359, p. 28.

CORNWALL MAGNETITE MINE AREA

LOCATION

The Cornwall mines and open pit have ceased production. However, an excellent view of the open pit can be seen from a vantage point along old U.S. Route 322 between the Borough of Cornwall and Miners Village, opposite the base of Big Hill. Before the operation closed, good collecting was available in the dumps at the base of Big Hill, across the road from where the pit can be viewed.

About the time the Cornwall mines were closing, large quantities of mine-waste material were hauled a short distance east of Miners Village for fill material over a small, flat area alongside the highway and over an unimproved secondary road. From these two localities (marked with arrows on the map) it should be possible to collect the same mineral assemblage that was present in the famous collecting areas around the mines. These two sites along U.S. Route 322 are approximately 0.5 mile from the southeast corner of the Cornwall Borough boundary as shown on the Lebanon and Richland quadrangles. The sites themselves are located in the Richland quadrangle.

MINERALS

Actinolite (amphibole group): var. byssolite; in calcite vugs and compact fibers

Albite (feldspar group): in the groundmass of micropegmatite and aplite; not visible

Amphibole group: see actinolite, hornblende

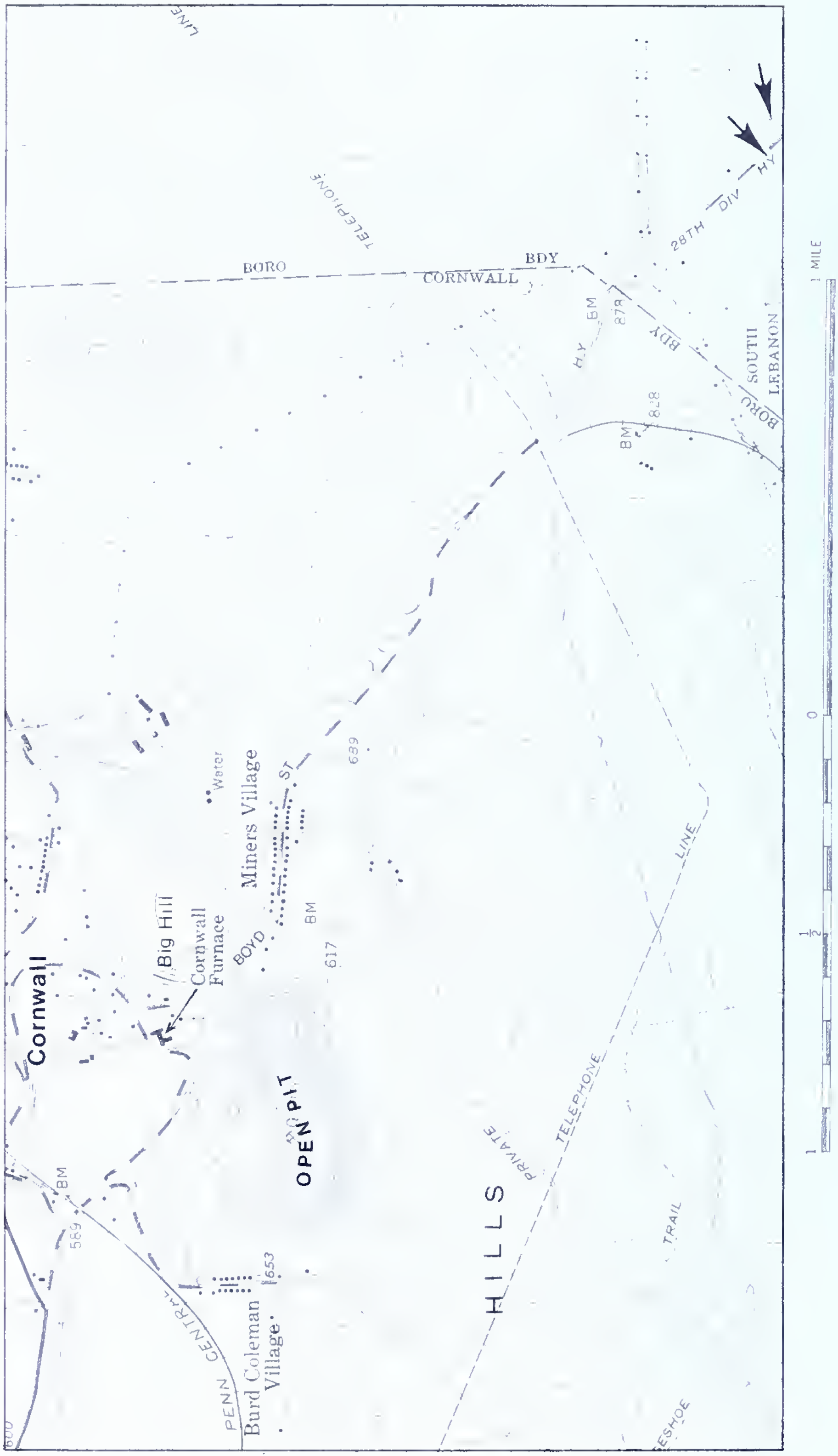
Analcime: uncommon; crystals in vugs with other zeolites, rarely with triangular, etched growth faces

Andradite (garnet group): dark colored

Antigorite (serpentine group): green, massive; often in limestone; in veins in diabase

Apatite group: species unknown; rare; associated with calcite in small veinlets; microcrystals

Apophyllite: clear, white crystals with zeolites in vugs


Cornwall
Big Hill
Cornwall Furnace
Miners Village
Water
BOYD ST
OPEN PIT
Burd Coleman Village
PENN CENTRAL
HILLS
PRIVATE TELEPHONE LINE
TELEPHONE
TRAIL
BORO CORNWALL BDY
BORO SOUTH LEBANON BDY
28TH DIV HY
BM
617
689
653
589
878
838
0
1/2
1 MILE

Aragonite: uncommon; usually a coating; crystals reported
Augite (pyroxene group): in diabase only
Azurite: uncommon; coating with malachite
Biotite (mica group): at the ore footwall with magnetite, pyrite crystals and in diabase with aplite veins (light-colored, fine grained igneous rock); in "blue conglomerate"
Brochantite(?)
Brucite: rare; in white to clear crystal flakes with serpentinized marble
CALCITE: crystals and cleavages; with zeolites; in ore; in recrystallized limestone
Chalcanthite: blue, secondary crusts on waste dumps
Chalcocite: rare; massive; not collected in recent years
CHALCOPYRITE: tetrahedrons; massive; in ore, limestone and conglomerate
Chlorite group: species unknown; rarely crystal prisms; associated with actinolite
Chrysotile (serpentine group): rare; at diabase-limestone contact
Chrysocolla
Clinozoisite: uncommon; very small crystals associated with chlorite
Copper: native; wire; very rare today
Cuprite: rare; small crystals
Datolite: rare; white to pale-green; small equigranular or prismatic crystals of simple habit; in ore and aplite; also massive in vein from open pit
Diopside (pyroxene group): crystals rare; near top of diabase; in limestone and Mill Hill slate
Elbaite(?) (tourmaline group): rare; microscopic; associated with ferriferous orthoclase in pink "blue conglomerate"
Enstatite (pyroxene group): in diabase pegmatite, especially Elizabeth open pit mine at concentrator plant
Epidote: pistachio green, generally massive; rarely prismatic crystals
Erythrite: uncommon; coating; may be mistaken for pink muscovite

Feldspar group: see albite, microcline, orthoclase
Fluorite: rare; cleavages and colorless cubes; in ore and in veins in diabase (Hickok, 1933); purple with calcite in veins in diabase
Forsterite (olivine group): reported in diabase
Galena: very rare; cleavages in limestone
Garnet group: see andradite, grossular
Grossular (garnet group): golden color; in recrystallized limestone
Gypsum: rare; massive; also var. selenite as cleavages
HEMATITE: hexagonal plates often replaced by magnetite; in ore and calcite
Heulandite: uncommon; crystals in vugs; colorless to white
Hornblende (amphibole group): in diabase; not visible to naked eye
Hypersthene (pyroxene group): in diabase and diabase pegmatite
Ilmenite: in diabase pegmatite; crystal plates rare
MAGNETITE: octahedrons, dodecahedrons; plates; massive; in ore and along top surface of diabase in small crystals
Malachite: coating and small crystals
Mica group: see biotite, muscovite, phlogopite
Microcline (feldspar group): in aplite, Mill Hill slate and "blue conglomerate"; not visible to naked eye
Millerite: very rare; small needle crystals with calcite in vugs
Muscovite (mica group): manganese-sodium bearing variety; pink, powdery, resembling erythrite; in ore, usually greenish
Natrolite: crystal hairs with other zeolites
Olivine group: see forsterite
Orthoclase (feldspar group): iron-bearing variety; pink; in salmon-colored igneous rock and "blue conglomerate" vugs
Phlogopite (mica group): crystal flakes associated with actinolite

Pigeonite (pyroxene group): in diabase only
Prehnite: uncommon; small crystal groups in vugs with orthoclase and zeolites; Mill Hill slate
PYRITE: cubes, pyritohedrons; up to one inch across cube edge
Pyroxene group: see augite, diopside, enstatite, hypersthene, pigeonite
Quartz: massive; small crystals
Rutile(?): rare; microscopic; associated with ilmenite
Serpentine group: see antigorite, chrysotile
Stilbite: small crystals and crystal clusters with calcite, pyrite and natrolite; also in fractures within diabase; sometimes with a pink tint
Sphalerite: rare; small crystals
Talc: associated with serpentine in veins
Titanite (sphene): very small crystals in aplite
Tourmaline group: see elbaite
Tremolite: blades; less common than actinolite; in limestone
Vesuvianite (idocrase): rare; generally massive
Wurtzite: rare; 4H or 6H polytypes as pyramidal crystals with marcasite, calcite; microscopic

GEOLOGY

The minerals found at Cornwall are associated with two major rock types: diabase and limestone. The Triassic diabase is an igneous rock of dark green to black color containing feldspars (mostly labradorite) and pyroxenes, with minor amounts of biotite, ilmenite and hornblende. The diabase formed by crystallization of these minerals from a molten rock that cut upward through surrounding Cambrian and Ordovician limestone. This diabase, as it cooled and solidified, recrystallized some of the limestone into marble. Several minerals, such as diopside, actinolite, epidote, and garnet, also formed in the limestone partly as a result of the heat from the diabase and partly as a result of the addition of some chemical elements from the final crystallization of diabase. Later, additional solutions spread outward along the top of the diabase into the limestone. The magnetite, hematite, pyrite, chalcopyrite, actinolite and chlorite formed at this stage. Sometimes they replaced the limestone, and sometimes they replaced the previously formed diopside and actinolite. The zeolites, sulfates, hydroxides, and copper carbonates crystallized last, filling open fractures and cavities. The consequence of this series of geologic events has resulted in certain minerals occurring together. Three such examples are the associations 1) magnetite-chalcopyrite-actinolite, 2) zeolites-chlorite-magnetite, and 3) garnet-tremolite-calcite-serpentine. The "blue conglomerate" mentioned above is a dark textureless rock with pink to orange-pink angular "fragments" (iron-orthoclase) and is vuggy. The Mill Hill slate is limy hornfels that resembles shale. The age of the ore deposit is approximately 190 million years, which is within the Triassic period.

Cornwall had its beginnings in pre-Revolutionary War days. Peter Grubb began prospecting in the 1730's and built a charcoal furnace, named "Cornwall Furnace", in 1742. This later date is the usually accepted date for the start of mining at Cornwall. From that time to the present, the mines have taken part in a large share of this nation's history. In 1777, Hessian prisoners made shot, shells, and cannons for the Continental Army, and in every succeeding war, the iron ore from Cornwall has played a major role. From two underground ore bodies, the large open pit, and several smaller open pits, the Cornwall ores were in continuous operation for over 230 years.

The Cornwall Furnace has been restored and can be seen today as a museum operated by the Commonwealth. Visitors to the area are urged to include a stop at this historic site in their itinerary. Attention should also be focused on the interesting architecture visible in Burd Coleman Village (see map) and Miners Village.

SIMILAR OCCURRENCES

Dillsburg, York County; Morgantown and Wheatfield, Berks County; French Creek and Warwick, Chester County

REFERENCES

Gray, Carlyle (1956), *Diabase at Cornwall, Pennsylvania,* Pa. Acad. Sci. Proc., v. 30, p. 182, 185.

Gray, Carlyle and Lapham, D. M. (1961), *Guide to the geology of Cornwall, Pennsylvania,* Pa. Geol. Survey, 4th ser., Gen. Geology Rept. 35, 18 p.

Hickok, W. O. (1933), *The iron ore deposits at Cornwall, Pennsylvania,* Econ. Geol., v. 28, p. 193-255.

Lapham, D. M. (1968), *Triassic magnetite and diabase of Cornwall, Pa.,* in Ridge, J. A., ed., *Ore deposits of the United States: 1933-1967,* (Graton-Sales Volume), v. 1, New York, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 72-94.

Lapham, D. M. and Gray, Carlyle (1973), *Geology and origin of the Triassic magnetite deposits and diabase at Cornwall,* Pa. Geol. Survey, 4th ser., Min. Resource Rept. 56, 343 p.

Spencer, A. C. (1908), *Magnetite deposits of the Cornwall type in Pennsylvania,* U.S. Geol. Survey Bull. 359, 102 p.

NOTES

H. J. SMITH LIMESTONE QUARRY

LOCATION

This is an active quarry just southeast of Pa. Route 241 and approximately 1.3 miles south of the intersection of U.S. Route 322 and Pa. Route 241 in South Annville Township. The quarry is located in the Lebanon quadrangle. Permission to collect must be obtained at the quarry office and all safety equipment must be worn while on the premises.

MINERALS

Anatase: blue; microcrystals
Apophyllite: clear, tabular crystals

Aragonite: cream to red-brown; banded
CALCITE: large masses
Chalcopyrite: massive and small crystals
Chlorite group
Cobaltite: rare; microcrystals with anatase
Galena: rare
Garnet group: probably grossular and andradite; gemmy golden dodecahedrons
Gypsum: var. selenite; fibrous, silky luster; unusually large specimens
Hematite: coatings; also crystals
Pyrite: small cubes; disseminated in limestone
Pyrrhotite
Quartz: massive; milky
Sphalerite: good, small crystals

Looking west into the H. J. Smith quarry. Note fault contact between the limestone and the diabase, slate and conglomerate.

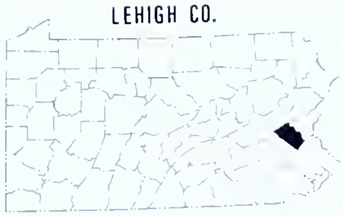
GEOLOGY

The quarry exposes a contact between the Buffalo Springs limestone (Cambrian) and the Ordovician(?) Mill Hill slate — "blue conglomerate" sequence. This contact is marked by a fault that crosses the southeast corner of the quarry. The gypsum is probably associated with this fault. Slickensides (groves caused by the sliding of the rocks against one another) and serpentinized fault surfaces are common in the south wall. Many solution cavities and channels can be seen in the limestone on the north wall and along the top. The limestone adjacent to the fault is greenish-gray in color and is completely recrystallized.

REFERENCE

Geyer, A. R. (1970), *Geology, mineral resources and environmental geology of the Palmyra quadrangle, Lebanon and Dauphin Counties, Pennsylvania*, Pa. Geol. Survey, 4th ser., Atlas 157d, 46 p.

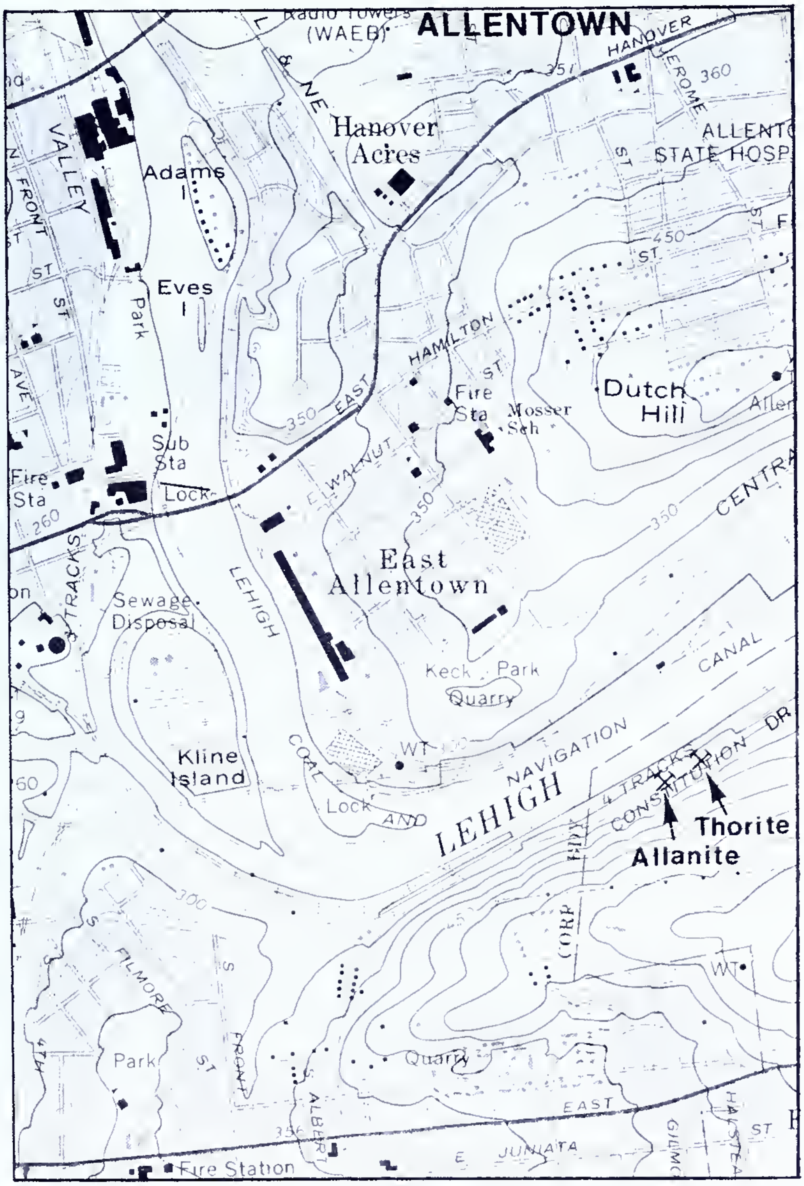
Selenite, the fibrous variety of gypsum, from the Smith quarry



CONSTITUTION DRIVE RARE EARTH MINERAL LOCALITIES

LOCATION

Two small quarries are located on the south side of Constitution Drive between Allentown and Fountain Hill. The granitic pegmatite quarry is 875 feet (about 0.2 mile) east-northeast of the Allentown-Salisbury Township boundary and 210 feet east of a prominant spring. The upper level of



the pegmatite quarry can be entered by a trail which leaves Constitution Drive 420 feet east of the lower quarry. The basal conglomerate quarry is located 1200 feet east-northeast of the Allentown-Salisbury Township boundary (Allentown East quadrangle).

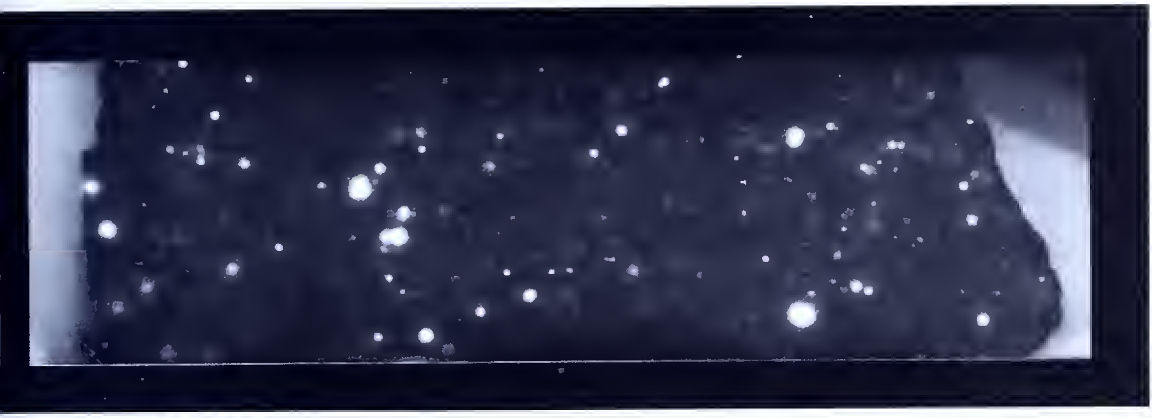
MINERALS

Pegmatite quarry (Allanite locality):

- ALLANITE: abundant; tabular, dark brown to black crystals also disseminated masses up to one inch
- Bastnaesite: waxy to chalky yellow grains with allanite
- Chalcopyrite: rare; tiny grains
- Epidote: pistachio green; especially common on slickensides
- Ilmenite: black plates
- Magnetite: black, disseminated grains
- ORTHOCLASE-MICROCLINE(?): salmon-pink cleavages in granite
- Pyrite: tiny cubes altering to "limonite"
- Pyrrhotite: brassy, yellow grains
- QUARTZ: smokey grains in granite
- Thorite: uncommon; tiny red-orange resinous grains in allanite; nearly metamict
- Titanite (sphene): small, golden-brown grains and cleavages
- Zircon: uncommon; crystals up to $^{3}/_{16}$ inch

Conglomerate quarry (Thorite locality):

- Ilmenite: black, opaque grains
- MAGNETITE: abundant; black opaque grains; some good octahedrons
- Muscovite: fine-grained, greenish, waxy masses (pinite) resembling "serpentine"
- Orthoclase-microcline(?): pink to lilac grains
- THORITE: common; red-orange resinous grains usually about $^{1}/_{16}$ inch but up to ¼ inch
- ZIRCON: very common; lilac to brown; sharp and water-worn crystals



Radiographs of radioactive thorite and zircon grains in conglomerate from the base of the Hardyston Formation

GEOLOGY

The pegmatite quarry is located in a granitic pegmatite that was excavated for building stone. This rock has usually been referred to as the intrusive Byram granite but it could also be a thoroughly metamorphosed sediment. Because this is one of the richer allanite occurrences in the state, a tremendous enrichment of rare elements such as lanthanum, cerium, yttrium, and thorium has taken place in forming these rocks. Similar occurrences in this area have been dated at about 800 to 900 million years, suggesting that this occurrence is Precambrian in age.

The conglomerate quarry is located at the base of the Lower Cambrian Hardyston Formation. The buried floor of the quarry is probably composed of Precambrian gneiss. Over this a few feet of soft pinite (the fine-grained muscovite rock, resembling serpentine, which contains good zircon crystals a few miles to the east) remains from the soil that once covered the gneiss. A hard ledge above the pinite marks the 600 million year old Precambrian-Cambrian unconformity formed about the time that the first life forms having hard parts that could be preserved as fossils developed elsewhere. Here, however, rather than fossil plants and animals, the resistant heavy and hard insoluble minerals accumulated from the weathering Precambrian rocks and today make up a fossil placer deposit. The lowest foot of hard, black rock above the pinite is the fossil (old, preserved) placer, which is enriched in magnetite, zircon, and thorite (see radiographs). X-ray fluorescence analyses of this rock show that it contains unusually large amounts of Fe, Ti, Zr, Th, Y, Sr, Rb, Hf, La(?), Pr(?), and Nb(?) in approximate decreasing order of abundance.

SIMILAR OCCURRENCES

Pegmatite: Road cut of Pa. Route 309 through South Mountain, Mountainville, Lehigh County

Conglomerate: Numerous, unnamed quarries on the north slope of Lehigh Mountain and float on the south slope of Dutch Hill, Lehigh County

REFERENCES

Aaron, J. M. (1969), *Petrology and origin of the Hardyston quartzite (Lower Cambrian) in eastern Pennsylvania and western New Jersey*, in Subitzky, Seymour, ed., *Geology of selected areas in New Jersey and eastern Pennsylvania, and guidebook of excursions*, New Brunswick, N. J., Rutgers Univ. Press, p. 21-34.

Miller, B. L. (1941), *The geology and mineral resources of Lehigh County, Pennsylvania*, Pa. Geol. Survey, 4th ser., County Rept. 39, 492 p. (includes a description of the Hardyston p. 165-180, the descriptive mineralogy of the county p. 443-470, and map showing most quarries).

Smith, R. C. II (1967), *Geochemistry and mineralogy of allanite from the eastern end of the Durham-Reading Hills*, unpub. report, Easton, Lafayette College.

———— (1974), *Uranium in the Hardyston Formation*, Pennsylvania Geology, v. 5, no. 3, p. 11-12.

JERSEY SHORE STRONTIANITE — CALCITE LOCALITIES

LOCATION

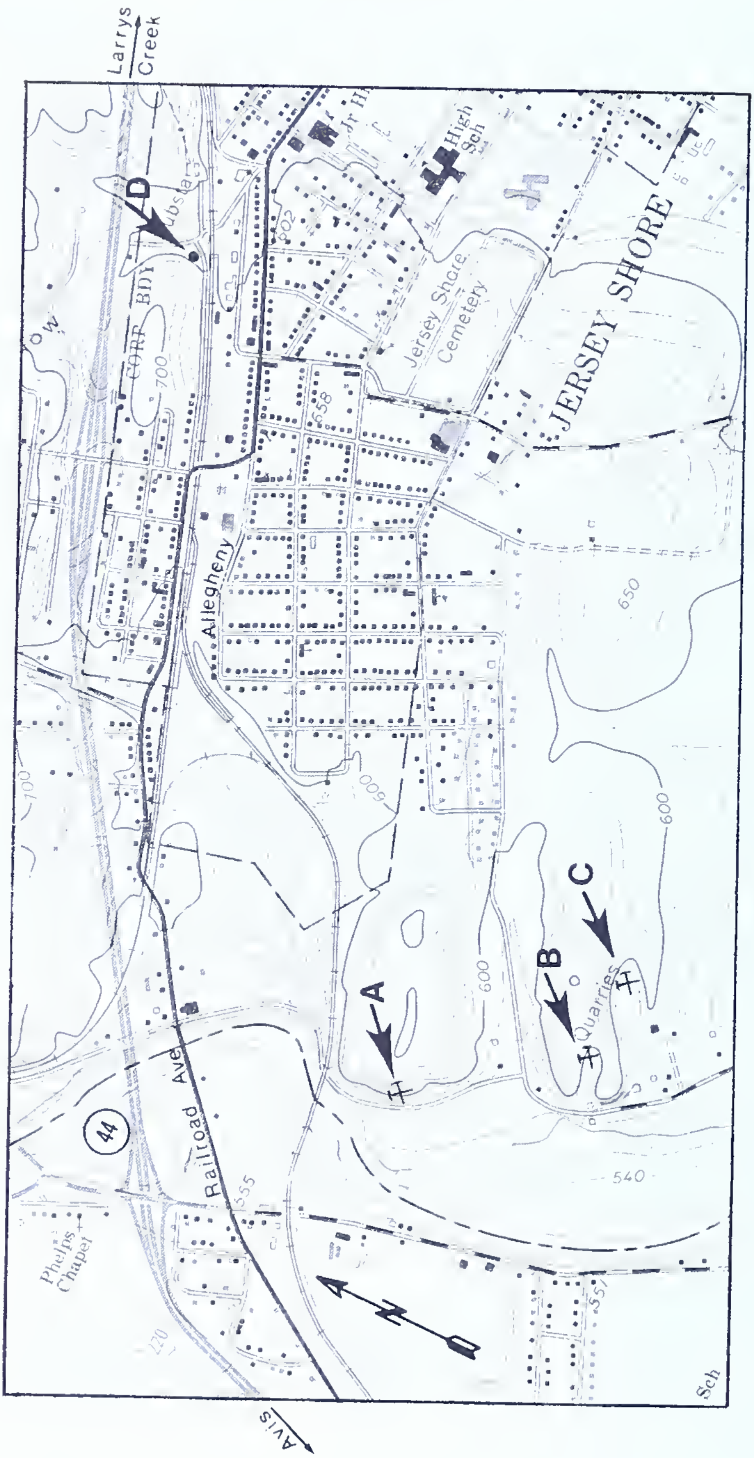
Four abandoned quarries are located near Jersey Shore, in the Jersey Shore topographic map. Quarry A, in Porter Township, can be reached by turning south from Railroad Avenue at the eastern end of the bridge over Pine Creek, and proceeding for approximately 0.4 mile on an extremely poor road. The quarry is on a hillside to the east of the road. Quarries B and C, also in Porter Township, can be reached by continuing south on this road for an additional 0.5 mile, or by traveling south and southwest on Main Street to the eastern end of the bridge over Pine Creek, turning north and proceeding over better roadway for 0.7 mile. These quarries may also be reached by turning south on Oak Street from Allegheny Street, then turning west at the southern terminus of Oak Street and proceeding for about 1 mile. Quarry D is near the northern boundary of Jersey Shore and is reached by traveling northwest from Allegheny Street at the curve for 0.2 mile. Although all four quarries are abandoned, the buildings at quarries B and C are being used by the Allegheny Sand Company to process material shipped from elsewhere, and permission to collect must be obtained at the office.

MINERALS

CALCITE: light yellow, white to clear; sometimes fluorescent in ultraviolet light; crystals of varied habits (all quarries)

Dolomite: uncommon; white, curved, rhombic crystals (quarries A, B, and C)

Fluorite: uncommon; small, purple cleavages; associated with calcite and strontianite (quarries A, B, and C)


Larrys Creek
Avis
A
B
C
D
Quarries
JERSEY SHORE
Jersey Shore Cemetery
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Allegheny
Railroad Ave
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Phelps Chapel
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N
650
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658
Sch

Pyrite: spherical to ellipsoidal nodules, some larger than 1 inch; fine microcrystalline texture; weathered near surface, forming "limonite" streaks on the rock surface; fresh material obtained deeper in the shale (quarry D)
Quartz: crystals up to ½ inch in length (quarry D)
Strontianite: tufts of small white radiating crystals; associated with calcite (quarries A and C)

GEOLOGY

The limestone quarried at A belongs to the Silurian Tonoloway Formation and the overlying (younger) Silurian-Devonian Keyser Formation. The Tonoloway is thin bedded, mostly devoid of fossils, while the Keyser is massive, cobbly, thick-bedded, and contains many fossils. Quarry B contains limestone of the Devonian Onondaga Formation, and quarry C contains the Onondaga on the north wall and the Tonoloway on the south and east walls, separated by a fault. Millions of years after the flat layers of limestone formed beneath a shallow sea, mountain building forces distorted and lifted the rocks of eastern and central Pennsylvania, creating many folds and faults in the rock layers. One such fold, called an anticline (beds curved convex upward) can be seen in quarry A. The forces causing the folding also created many voids in the limestone. Watery solutions moving through the limestone dissolved some of the carbonate minerals and redeposited them in the voids, thus forming the crystals of calcite, dolomite, and strontianite. Quarry D contains shale of the Devonian Tully Formation. The pyrite in the shale was probably formed by microorganisms that lived in the sea while the shale was being deposited.

LIME BLUFF LIMESTONE QUARRIES

LOCATION

The Lime Bluff quarries are located 5.25 miles northeast of Muncy, in Wolf, Muncy, and Muncy Creek Townships. This area is in the northeast corner of the Muncy quadrangle. The best collecting is in the "old" (southeast) quarry which is reached by taking Pa. Route 405 east from Muncy and turning left (north) onto Township Road 41095 about 0.2 mile past Muncy Creek. Alternately, the quarries may be reached from U.S. Route 220 by turning south toward Chippewa. The quarries are owned by Lycoming Silica Sand Company, a Koppers Company, with offices at 420 Broad Street, Montoursville. Small groups may often obtain permission for collecting between 8:00 a.m. and 5:00 p.m. weekdays and 8:00 a.m. to noon on Saturday from the Superintendent, Mr. Charles W. Rosenbaum, at the Lime Bluff Plant, R.D. 4, Muncy, Pa. 17756. Hard hats, safety glasses, and the signing of a release are always required for entry. The quarry is very active and collectors must not interfere with shovel, blasting, or other quarry operations.

MINERALS

Anglesite: gray rims on galena crystals and good, small gray-white crystals

Azurite: uncommon; beautiful, clear blue microprisms

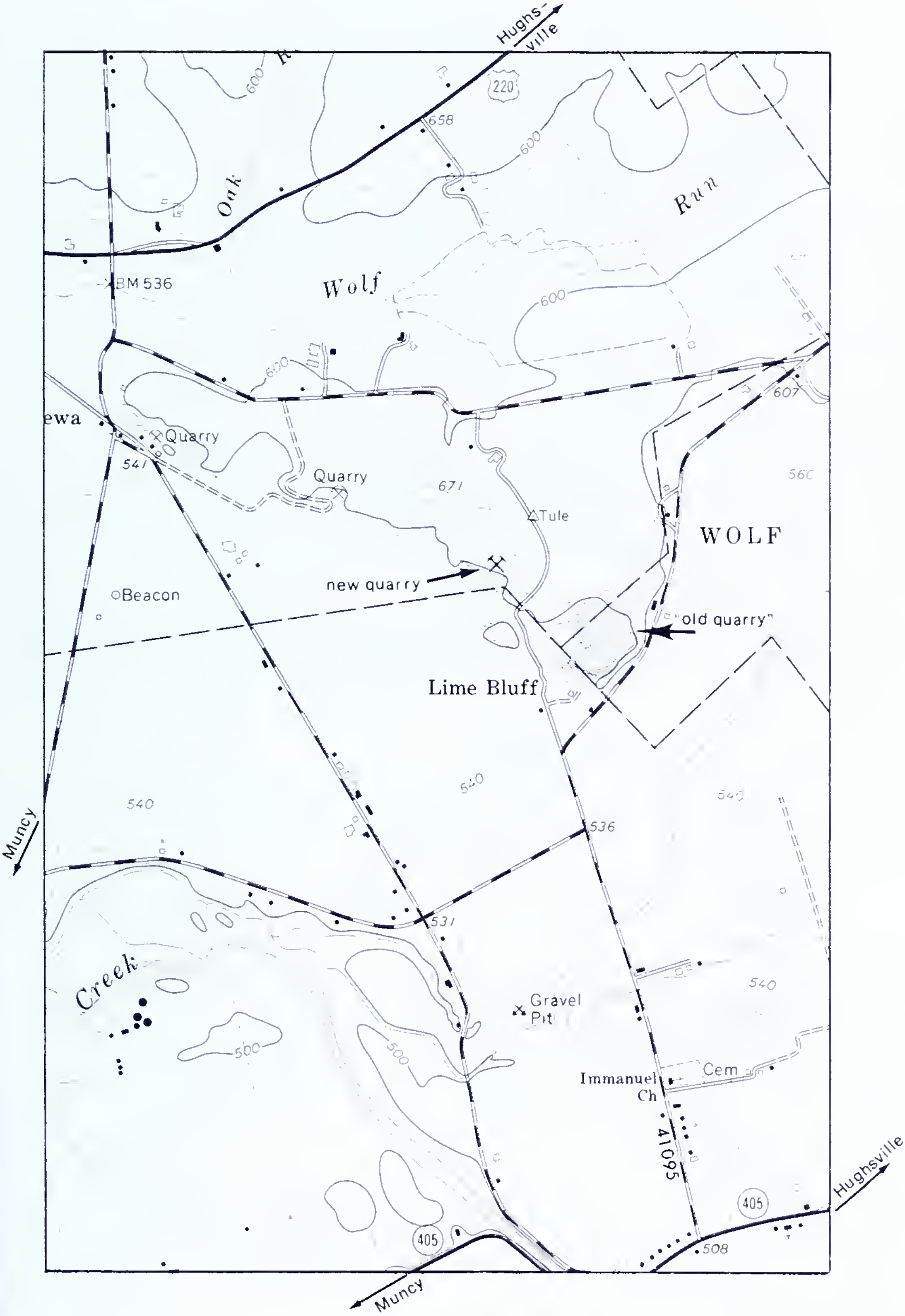
Barite: uncommon; white prisms

CALCITE: perfect white cleavages up to 4 inches on a side and pale yellow to colorless, clear scalenohedrons up to 2 inches; some fluoresce bright pink with short wave ultraviolet light

Celestine(?): white cleavages in the new quarry, not verified; could be barite

Cerussite(?): uncommon; microcrystals with galena

Chalcopyrite(?): micrograins in malachite-stained "limonite"


Hughsville
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new quarry
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Hughsville

Conichalcite: rare; yellow green; pseudomorphs after enargite prisms; mammillary and stalactitic growths
Cornubite: blue-green boxworks replacing enargite prisms; also beautiful pale blue-green acicular microcrystals in vugs
Dolomite: small, cream-colored cleavages in calcite veins
Enargite: metallic, steel-gray prisms with a good cleavage; usually partly altered to green, secondary copper minerals
Fluorite: uncommon; small purple cleavages in calcite veins
Galena: bright silvery cubic and cuboctahedron crystals up to one inch
Goethite: "limonite" pseudomorphs after 1/16 inch pyrite crystals and massive, porous, earthy blocks up to 1 foot
Hemimorphite: uncommon; lustrous, clear crystals with smithsonite and sphalerite
Hydrozincite: uncommon; fluoresces blue in short wave ultraviolet light; thin coatings on calcite near sphalerite
MALACHITE: common green coatings and poor microcrystals near enargite
Pyrite: small crystals up to ⅛ inch
Quartz: massive in some calcite veins; also thin, needle-like crystals up to ½ inch in limestone vugs, especially from the new quarry
Smithsonite: yellowish; mammillary and rhombs near sphalerite
SPHALERITE: brilliant, orange to ruby-red cleavages up to 2 inches from the lower level of the "old" quarry; also the less attractive dark brown to golden colors
Strontianite: good tufts of white crystals from the new quarry; may be the calcian variety

GEOLOGY

The host rock for the interesting minerals on the south side and lower level of the "old" quarry is the Silurian Tonoloway Formation. The Tonoloway at Lime Bluff is a thin, platy limestone containing black, clay-carbon layers. Fossil mud cracks are preserved in the shaly limestone. The copper, arsenic, zinc, lead, and strontium probably accumulated with the sediments. During deformation, long after lithification of the limestone, these metals were remobilized and concentrated along calcite-filled joints and fractures. The conichalcite, cornubite, goethite, hemimorphite, hydrozincite, malachite, smithsonite, and strontianite are secondary minerals formed by near-surface groundwater alteration. Strontianite occurs in limestone of the Keyser Formation in the new quarry and northern part of the old quarry.

REFERENCE

O'Neil, Thomas (1973), personal communication on zinc-lead mineralization at Lime Bluff, Montoursville.

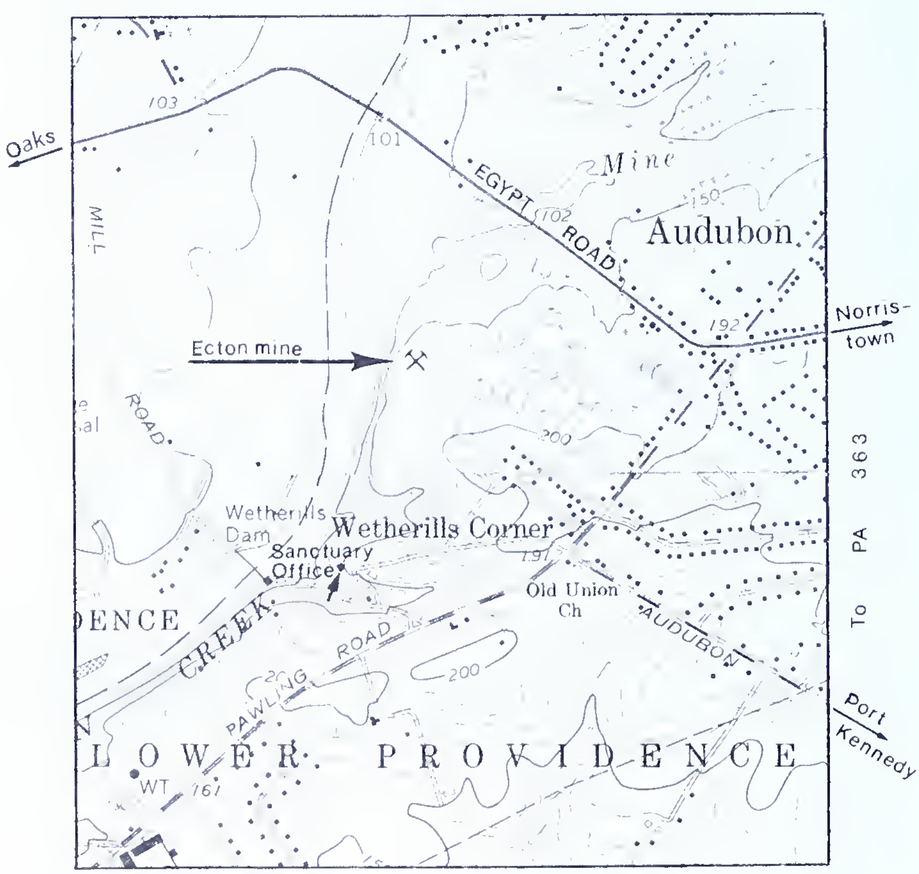
NOTES

ECTON MINE COPPER-ZINC-LEAD LOCALITY

LOCATION

The Ecton mine dumps are located on the Audubon Wildlife Sanctuary, "Mill Grove," Audubon, in the southern part of the Collegeville quadrangle. "Mill Grove" is located 0.7 mile southwest of Audubon and best entered by turning west from Pawling Road onto Audubon Road at Wetherills Corner. The sanctuary office is in the Audubon mansion about 0.4 mile from Pawling Road. The collecting area is about 2000 feet northeast of the Audubon office, where a trail map showing the area for mineral collecting may be obtained.

The sanctuary, owned and maintained by Montgomery County, is primarily a historic site with the additional advan-



tage of being a wildlife refuge. Mineral collecting therefore represents a conflict of interests. In order to prevent total exclusion of collectors, now under serious consideration, it is essential that the regulations be strictly followed: picnicking, bicycling, pets, picking of flowers or shrubs, digging outside mine dump areas and digging under trees is prohibited. In addition, all digging must be backfilled, and groups must be limited to a maximum of twelve.

MINERALS

Anglesite
Aragonite
Azurite: deep, inky blue
Barite: small, thin, white or clear, glassy tabular crystals
Brochantite: thin, emerald-green crystalline coating
Cerussite: white microcrystals including twins
CHALCOPYRITE: rich masses in quartz with "limonite" and malachite
Chlorite group: species unknown; rosettes of green microcrystals
Chrysocolla
Devilline: robin's-egg blue; scaly microcrystals with a pearly luster
Galena
Goethite: as "limonite" in vein quartz
Greenockite: very rare; bright yellow stains
Hemimorphite: colorless, tabular microcrystals; difficult to distinguish from barite from this locality
Langite: rare; greenish-blue microcrystals with posnjakite
Leadhillite(?): very rare
Linarite: medium-blue, platy microcrystals; often with cerussite or galena
MALACHITE
Posnjakite: rare; greenish-blue microcrystals with langite
Pseudomalachite: rare; blue-green mammillary crusts on quartz
Pyrite
Pyromorphite: pistachio-green crystals and crystalline masses

QUARTZ: white, crystalline vein material
Silver: very rare; wires
Sphalerite: lemon-yellow to golden-brown gemmy cleavages
Susannite(?): very rare
Wulfenite: tabular crystals reported

GEOLOGY

Each of the deposits consists of a vertical quartz vein rich in the primary sulfides sphalerite, galena, and chalcopyrite. These veins cut through the red sandstone of the Brunswick Formation of Triassic age. The original vein minerals were deposited in open fractures. The source of the hydrothermal solutions that furnished the metals is unknown. Most of the other minerals have formed by the reaction of ground water with the primary sulfides.

From south to north, the Ecton mine area includes the Wetherill mine or Old Perkiomen mine or United mine, the Ecton mine, the Whim Shaft of the Perkiomen mine, and the Perkiomen mine itself. Mining for lead was begun by James Audubon's father at the Old Perkiomen mine. More serious lead mining was begun shortly after 1810 by Samuel Wetherill.

By the 1850s mining was resumed by the Perkiomen Mining Company but this time for copper. Zinc, present as rich sphalerite in the veins, was never recovered. At present, collecting is only permitted at the Ecton mine dumps.

SIMILAR OCCURRENCES

New Galena, Bucks County and the Phoenixville District, Chester County

REFERENCES

Miller, B. L. (1924), *Lead and zinc ores of Pennsylvania*, Pa. Geol. Survey, 4th ser., Min. Resource Rept. 5, 91 p.

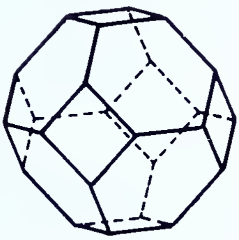
Montgomery, Arthur (1969), *Mineralogy of Pennsylvania, 1922-1965*, Acad. Nat. Sci., Philadelphia, Spec. Pub. 9, p. 25-26, 29-30.

KIBBLEHOUSE QUARRY-ZEOLITE LOCALITY

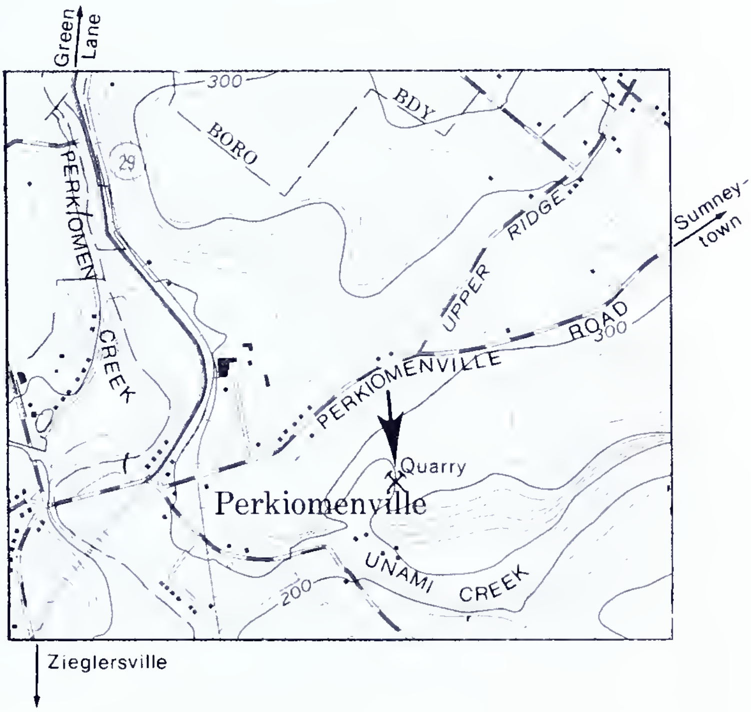
LOCATION

The Kibblehouse quarry is located on the northeast side of Perkiomenville Road, 0.4 mile southeast of Perkiomenville and Pa. Route 29 toward Woxall, in the Perkiomenville quadrangle. The entrance to the quarry is where Unami Creek crosses beneath Perkiomenville Road. Groups must write in advance to Mr. Ardell Wilson, Kibblehouse Quarries, Bridgeport, Pa. 19405. In addition, the following regulations and rules are in effect:

1) All collectors must stay away from the quarry walls and off the inclined talus-blast piles.
2) Collecting is permitted only by organized groups with no person under 12 years of age permitted.
3) No collecting is permitted in the rain.
4) A fee is charged; this fee to cover company expenses of an employee to be on duty at the time the group arrives and for the full time the group is in the quarry.
5) Hard hat, goggles, and steel-toes shoes must be worn by every member of the group.



Cobaltite Cuboctahedron



6) All groups must sign an agreement whereby they assume liability for any safety violation fine ($200-$500) that may be levied against the company as a result of the group's actions while collecting.

MINERALS

Actinolite (amphibole group): var. byssolite; in calcite veins (can be etched out with acid)
Albite: massive; microscopic grains in hornfels
Amphibole group: see actinolite, hornblende
Andradite (garnet group): clove to reddish brown; may have striated faces
Apophyllite(?)
Aragonite: crystal tufts; fluorescent
Arsenopyrite: uncommon; silvery, diamond-shaped plates in hornfels with traces of brown sphalerite
Axinite group: species unknown; rare; flat, wedge-shaped violet and brown crystals up to ½ inch across; in calcite veins with cobaltite
Azurite: bright blue spots
CALCITE: scalenohedrons, nail head, paper-like plates; fluorescent, milky white under long wave ultraviolet light
Chabazite: flesh pink to orange crystal rhombs up to ¼ inch
Chalcopyrite: small brassy grains; some crystals
Chlorite group: species unknown; green flakes, commonly on chabazite and stilbite
Chrysocolla: small, blue-green masses
COBALTITE: common; bright silvery octahedrons and cuboctahedrons as small crystals in green-gray hornfels; larger crystals up to ¼ inch in calcite veins; from northwest wall
Copper (native): uncommon; small sheets and masses in hornfels
Datolite: very pale green with glassy luster
Diopside (pyroxene group)
Epidote: small, pistachio-green crystals up to 1/16 inch

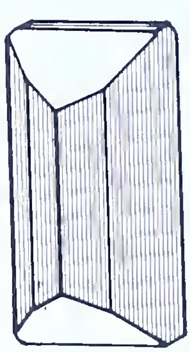
Cobaltite octahedron in hornfels from Kibblehouse

Erythrite: pink coatings with cobaltite
Fluorite: uncommon; small purple crystals
Galena
Garnet group: see andradite
Gersdorffite(?): gray, metallic with cobaltite; needs further study
Glaucodot: rare; very small, deeply striated prisms
Goethite: uncommon; "limonite" pseudomorphs after pyrite
Heulandite: colorless to yellowish crystals; twinned
Hornblende (amphibole group): tiny, black microcrystals with quartz and actinolite
Magnetite: massive; with parting and octahedral faces; found with andradite in quartz
MALACHITE: small needles and coatings, especially from the northeast wall
Marialite(?) (scapolite group): white to flesh-pink prisms
Montmorillonite: white, poorly crystalline, irregularly formed masses, usually coating calcite; unusual and may be mistaken for natrolite or aragonite
Natrolite: tufts of white, acicular microcrystals; radiating, concentric eyes
Orthoclase: white to flesh-pink microtablets
Prehnite: clear, colorless, stubby rectangular crystals; tabular crystals; and green to gray cleavages with heulandite or cobaltite
Pumpellyite: uncommon; pale, sea-green crystal prisms in white calcite

Pyrite: beautiful microcrystals on natrolite; also on chabazite
Pyrolusite(?): dendrites on joints and fractures
Quartz: small crystal groups; milky quartz veins
Sphalerite: tiny brown-red cleavages in hornfels with arsenopyrite
STILBITE: yellow to golden radiating sheaves
Titanite (sphene)

GEOLOGY

Most of the interesting minerals are found in vein fillings or vugs. The host rock is the Triassic Brunswick shale. This sediment has been baked by the igneous diabase sheet just to the northwest. The tough, baked rock is called a hornfels. The actual baking process is called thermal contact metamorphism. Albite, diopside, actinolite and garnet are typical contact metamorphic minerals which formed by recrystallization of the shale from the heat of igneous intrusion. This heat also helped the ground water remobilize and concentrate elements already in the hornfels to form zeolites and sulfides. Because the cobaltite is contained in one series of sedimentary beds down the length of the northwest wall, the necessary cobalt and arsenic may have been present in the original shale.



Glaucodot crystal

SIMILAR OCCURRENCE

Teeter quarry, Adams County

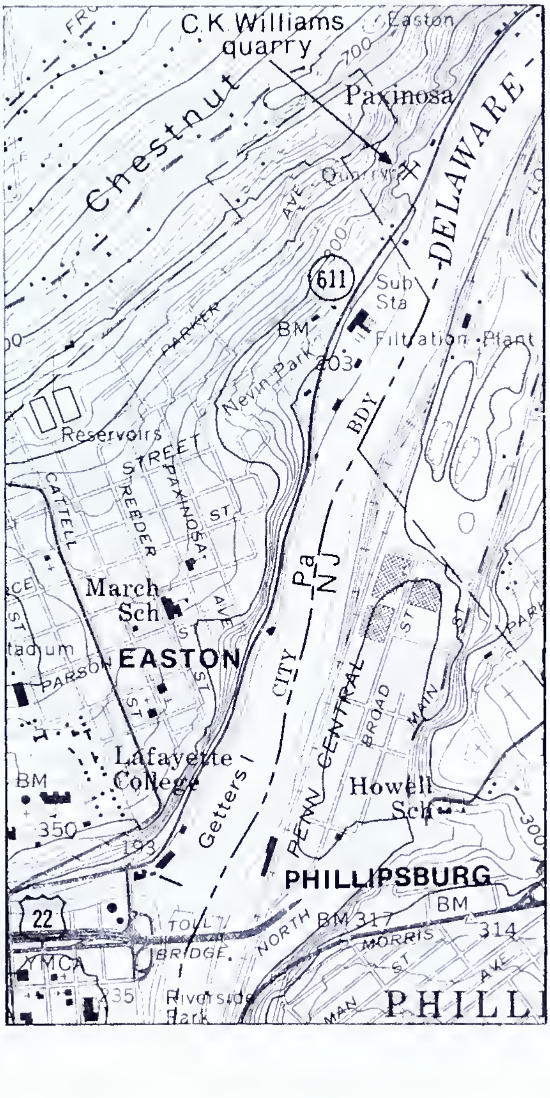
REFERENCE

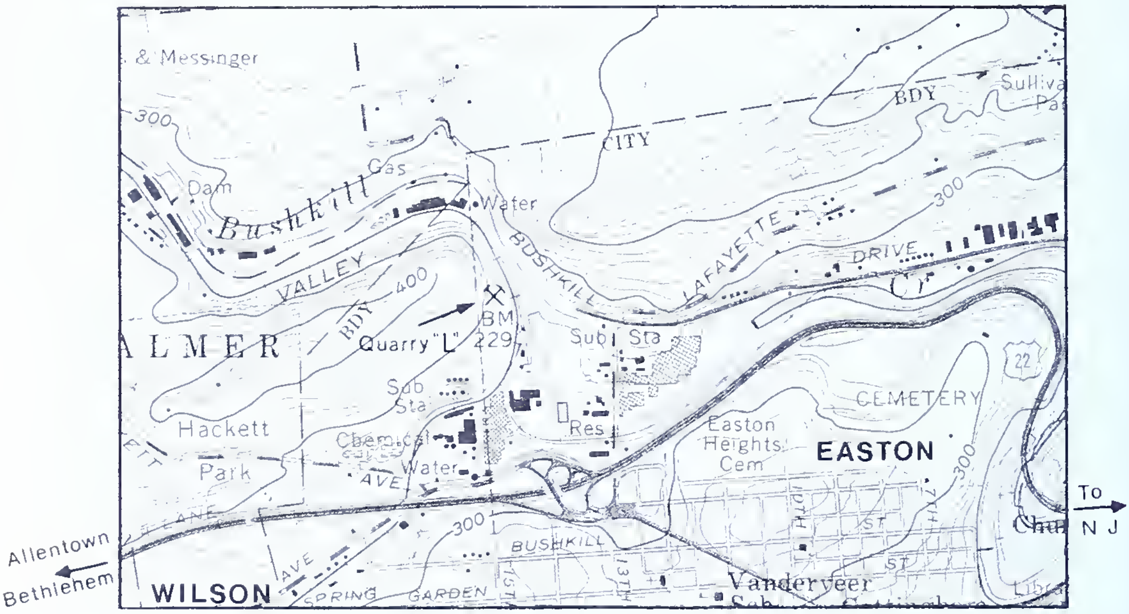
Montgomery, Arthur (1973), *Pennsylvania Minerals (128)*, Mineralogical Society of Pa., Keystone Newsletter, v. 22, no. 8, p. 8.

EASTON SERPENTINE LOCALITIES

LOCATION

The C. K. Williams quarry is located on the southeast side of Chestnut Hill in Forks Township in the Easton quadrangle. The quarry may be seen from Pa. Route 611 about 1.3 miles north of the intersection with U.S. Route 22. Permission to enter is necessary. It should be sought from the City of Easton through the Lafayette College Geology Department.





Quarry "L" is located on the west side of Bushkill Gap through Chestnut Hill, within the Easton city limits. This locality is 0.4 mile northwest of the 13th Street exit of U.S. Route 22 and 0.5 mile northeast of Hackett Park. Quarry "L" is on the fenced-in and continuously patroled property of the Pfizer Company. Pfizer will, however, consider admitting a limited number of small groups each year. Those who have obtained the necessary advance permission should report to the guard house on Wood Avenue for the signing of releases.

MINERALS

Williams Quarry:

- Apatite group: rare; species unknown
- Beta-uranophane: very rare; canary-yellow needles in cavities in serpentine
- Boltwoodite: rare; pale-yellow fibrous coatings and along the relic diopside parting in serpentine
- Calcite: white cleavage in veins and pods of unreplaced graphitic marble of the Franklin limestone; strontian calcite reported
- Chalcopyrite: grains in calcite
- Chrysotile: reported as fibrous asbestos but much of this may be tremolite

Diopside (pyroxene group): largely altered to serpentine but still shows relic parting
Dolomite
Dravite (tourmaline group): very rare; brown prisms
Fluorite: reported
Galena: rare; cleavages in calcite
Graphite: silvery-gray flakes in unreplaced Franklin marble
Malachite: coatings near chalcopyrite in calcite and with thorite
Molybdenite: blue-gray flakes in calcite and serpentine; now rare in the latter
PHLOGOPITE: very common; micaceous green flakes; also var. Eastonite(?)
PYRITE: small crystals in marble
Pyroxene group: see diopside
SCHORL: (tourmaline group) black crystals very common in Pa. Route 611 road cut to the north at St. Anthony's Nose

Masses of molybdenite in serpentine from the Easton area

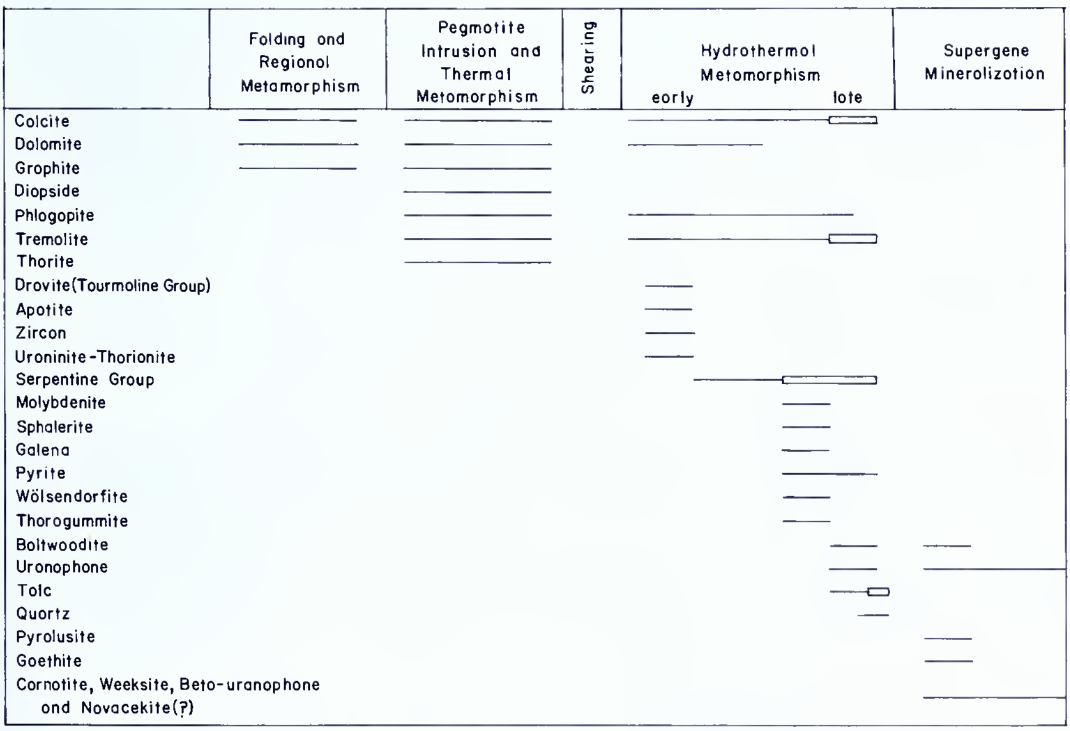
SERPENTINE GROUP: probably the species antigorite(?); possibly some lizardite(?), as massive green blocks
Sphalerite: uncommon; lemon yellow to greenish yellow in phlogopitic marble with pyrite
Talc
Thorianite: uranoan variety
Thorite: reddish in albite pegmatite and orange-brown with malachite in quartz and sheared pegmatite; rare in serpentine
Thorogummite: yellow-brown alteration rims around thorian uraninite
Tourmaline group: see dravite, schorl
Tremolite: common; white masses composed of fibrous blades
Uraninite: thorian variety as dark, radioactive grains in serpentine
Uranophane: pale-lemon-yellow coatings on serpentine; recently verified
Vermiculite group(?)
Vesuvianite(?)
Weeksite: thin, yellow coatings in fractures in serpentine; more common than previously thought
Zircon: uncommon; gray-brown zoned crystals, the largest of which were nearly two inches long

Quarry "L"

CALCITE: small white cleavages in veinlets cutting "serpentine"
Chalcopyrite: small brassy grains in calcite
Dolomite: small cleavages in veinlets
Galena: small, silvery grains with chalcopyrite in calcite
Malachite: green stains near chalcopyrite
PHLOGOPITE: very common; micaceous green flakes up to ½ inch
Pyrite: rare; cubes partly altered to "limonite" in schistose rock

SERPENTINE GROUP: olive green, massive, with phlogopite
Sphalerite(?)
Talc
Thorianite: uranoan variety
Thorogummite: chalky, pale yellow after thorian uraninite
TREMOLITE: fibrous; with talc; also massive crystalline beds
Uraninite: thorian variety; tiny, black grains in serpentine; rarely as cubic crystals with octahedral modification
Wölsendorfite(?): chocolate brown after thorian uraninite
Zircon: rare; small zoned crystals

PARAGENETIC SEQUENCE OF COMMON MINERALS OF EASTON SERPENTINE DEPOSITS
(wider lines indicate periods of greater mineralization)



adapted from Montgomery, 1957, p.808.

GEOLOGY

Both the Williams and "L" quarries are located in serpentine rock. Originally this rock was the Precambrian Franklin marble. Intrusion by hot magma that formed granite and pegmatite during Precambrian time metamorphosed the marble to tremolite, diopside, and perhaps phlogopite. Somewhat later, hydrothermal solutions altered these to serpentine group minerals such as antigorite and introduced the uranium and thorium as thorian uraninite and uranoan thorite. Lower temperature alteration has partially converted the primary uranium and thorium minerals into secondary minerals as thorogummite and wölsendorfite.

The earlier-reported autunite, carnotite, and meta-autunite may not occur at Williams quarry.

REFERENCES

Montgomery, Arthur (1957), *Three occurrences of high thorian uraninite near Easton, Pennsylvania,* Am. Mineralogist, v. 42, p. 804-820.

__________ (1969), *Mineralogy of Pennsylvania, 1922-1965,* Acad. Nat. Sci., Philadelphia, Spec. Pub. 9, p. 39-42, 55, 56.

__________ (1975), *Pennsylvania minerals, first and second postscript,* Mineralogical Society of Pa., Keystone Newsletter, v. 24, no. 5, p. 8-9 and no. 6, p. 7.

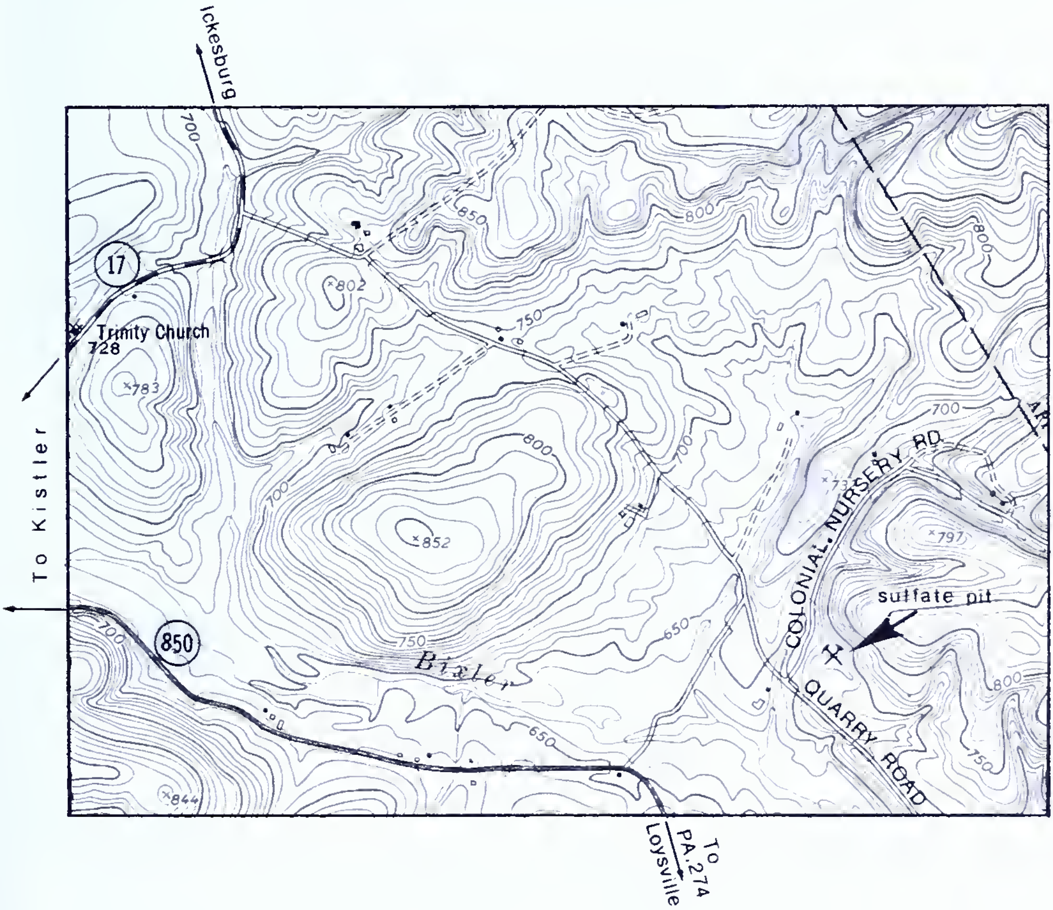
Peck, F. B. (1911), *Preliminary report on the talc and serpentine of Northampton County,* Pa. Geol. Survey, 3rd ser., Rept. 5, 66 p.

NOTES

NORTHEAST MADISON SULFATE LOCALITY

LOCATION

This location is an abandoned shale pit in Northeast Madison Township, on the Spruce Hill topographic map. The shale pit is 500 feet northeast of Quarry Road on Colonial Nursery Road, approximately 1.3 miles southeast of Pa. Route 17. Permission to collect must be obtained from the owner, Mr. Lynn Boose, whose home is located across Quarry Road from the pit.



MINERALS

Calcite: small, clear rhombohedral crystals in shale and in underlying limestone, exposed in places

Goethite: as "limonite" coatings on shale bedding planes

Gypsum: var. selenite; very small, clear plates and tabular crystals on bedding planes of shale

HALOTRICHITE: adundant; white and yellow efflorescence on the shale outcrop; magnification sometimes reveals tiny, clear, hair-like crystals coating the surface; much halotrichite might be intimately intermixed with lesser quantities of other sulfates of similar composition

Pyrite: partially weathered cubes and concretions in shale contain pyrite

Quartz: small crystals in shale, generally ¼ inch; some doubly terminated

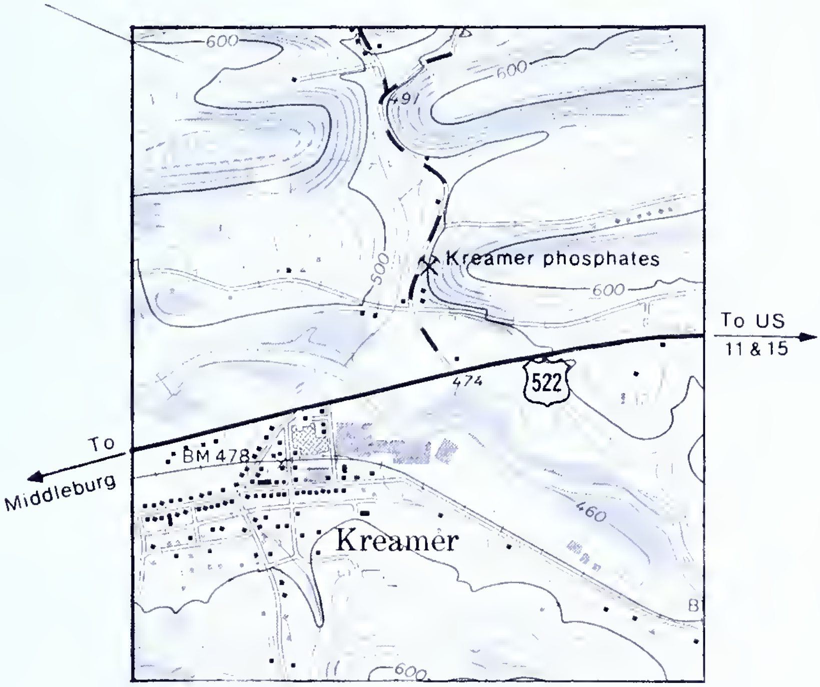
GEOLOGY

The shale at this location belongs to the Marcellus Formation, which was deposited as mud under marine conditions during the Devonian Period. The pyrite probably was formed at the same time by microorganisms that lived in the sea, in an environment that contained very little free oxygen. The raising of this shale above the sea over millions of years, and its subsequent exposure to the atmosphere and to ground water has resulted in the chemical breakdown of the pyrite, forming the sulfates, such as halotrichite.

KREAMER WAVELLITE LOCALITY

LOCATION

The Kreamer wavellite locality is in the Freeburg quadrangle about one half mile northeast of Kreamer. The small, inactive quarry is on the east side of a secondary road 1000 feet (0.2 mile) north of U.S. Route 522. This secondary road leaves U.S. Route 522 about 750 feet (0.15 mile) east of Middle Creek. At present, there is an abandoned schoolhouse across the secondary road from the quarry. Always ask permission and confine your collecting to loose material.



MINERALS

Beraunite: orange to red microcrystals

Cacoxenite: yellow to orange radiating microcrystals on fractures

Dufrenite(?): rare; pale greenish
Rockbridgeite: dark red-brown microcrystals on chert; also pale greenish coating
Quartz: drusy crystals on chert and the chert itself, some agate-like
WAVELLITE: abundant; radiating "sunbursts" up to ½ inch and crystalline spheres to ⅜ inch

GEOLOGY

The wavellite occurs in the Shriver Member of the Lower Devonian Old Port Formation. The Shriver is here composed almost entirely of chert, most glassy enough to cause bad cuts. This phosphate mineral occurrence is 68 feet beneath the shaly Needmore Formation. The phosphate to form the wavellite probably has dissolved from apatite in the Needmore and percolated downward with ground water until it precipitated in fractures in the chert. The best wavellite occurs in joints and fractures perpendicular to the beds that dip to the north at 38°. The fact that the wavellite crystal spheres are perched on top of quartz shows that the wavellite is the younger mineral.

Brachiopods and gastropods also occur at this locality. Three small quarries in the Keyser limestone a few hundred feet due east yield excellent marine fossils.

Because Carter (1969) found 0.2% zinc at a similar deposit, sphalerite was sought but not found at Kreamer. However, the next good outcrop of Shriver to the west yielded small, gemmy golden sphalerite cleavages.

SIMILAR OCCURRENCE

The W. L. Newman phosphate mine, Juniata County has produced wavellite and crandallite from the Shriver chert (Carter, 1969).

REFERENCE

Carter, W. D. (1969), *The W. L. Newman phosphate mine, Juniata County, Pennsylvania*, Pa. Geol. Survey, 4th ser., Inf. Circ. 64, 16 p.

MILLVIEW AREA
METALLIC MINERALS

LOCATION

The Millview quarry is located 0.9 mile north of Millview, in Forks Township, in the Overton quadrangle. From Millview proceed northeast on Pa. Route 87 for 0.45 mile and turn left onto an unimproved road immediately across the small bridge. Proceed north for about 0.5 mile, turn left across a small bridge and seek permission to park along the road before beginning up the hill. Walk up the east shore of Mill Creek for about 900 feet. The small quarry is about 20 feet above the east bank, immediately after passing a small tributary coming in from the west. The coquina (fossil shell limestone) beds are the best for mineral collecting. The quarry is on the Locke estate. The most interesting minerals are suitable only for micromounters.

McCauley's (1961) uranium-copper prospect number 31 is in a road cut on the north-northwest side of Pa. Route 87, about 2.3 miles (via the highway) west of Millview, Forks Township in the Overton quadrangle. The outcrop is about 550 feet southwest of the road along Big Bottom Run. The test pits north of the outcrop are barren and on the private property of Joseph Baebi's H J Ranch, where trespassing is forbidden.

MINERALS

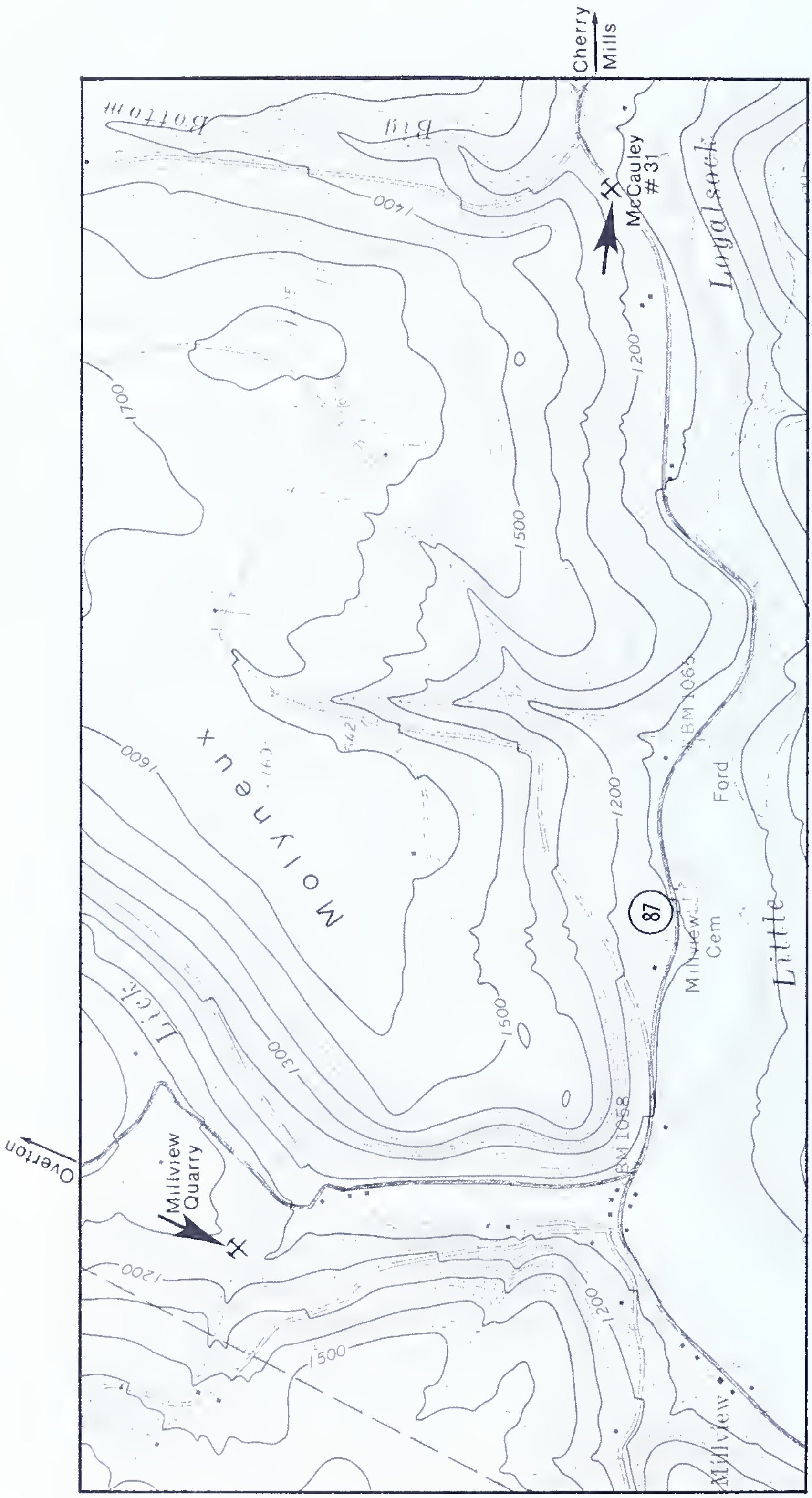
Millview quarry:

Arsenopyrite: sparse; shiny, thin, white rhombic prisms up to ⅛ inch in coquina near sphalerite; microscopic

Calcite: host rock, a fossiliferous limestone, and thin veinlets on vertical joints

Cerussite(?)

Chalcopyrite: minute grains


Cherry Mills
McCauley # 31
Big Bottom
Loyalsock
Little
Molyneux
Lick
Overton
Millview Quarry
87
Millview Cem
Ford
BM 1063
BM 1058
Millview
1400
1700
1500
1200
1600
1300

Galena: sparse; disseminated ⅛ inch grains and masses up to ½ inch on joints

Goethite(?): "limonite" crusts from the weathering of pyrite

Gypsum(?): small crystals in "limonite" formed by reaction of weathered pyrite and limestone

PYRITE: partial pyritic replacements of wood up to ½ x 12 inches, some showing details of wood structure

Sphalerite: disseminated grains and masses up to ¼ x 1 inch on joints; colors include colorless, yellow, brown, orange, and red

Prospect No. 31:

Aragonite(?): white to green tufts of radiating microcrystals that fizz with acid

Brochantite: beautiful emerald-green coatings of clear microcrystals in the interior of carbonaceous plant fragments

Chalcocite(?)

Covellite(?): indigo-blue coatings filling shrinkage cracks in carbonaceous plant fragments

MALACHITE: green coatings on bedding surfaces and on carbonaceous plant fragments

Unknown, uranium minerals: in carbonaceous plant fragments, making them radioactive

GEOLOGY

Both locations are in the Upper Devonian Catskill Formation. Most of this formation is composed of nonmarine, reddish siltstone. At the Millview quarry, however, the Catskill is represented by limestone beds composed of marine fossils (brachiopods and crinoids). At Prospect No. 31, the copper and uranium-rich lens is overlain by a bed of porous rock once composed of fossils in a marine limestone. Nevertheless, both occurrences contain abundant carbonaceous plant fragments, showing that nonmarine conditions existed in the same area. At the quarry, the metals were precipitated by the change in chemical conditions from nonmarine to marine. At Prospect No. 31, the metals may simply have replaced carbonaceous plant fragments in the bottom of a stream channel. This replacement may have occurred long after deposition of the sediments. The source of the solutions which transported the copper and uranium is unknown.

REFERENCE

McCauley, J. F. (1961), *Uranium in Pennsylvania,* Pa. Geol. Survey, 4th ser., Min. Resource Rept. 43, p. 64-65.

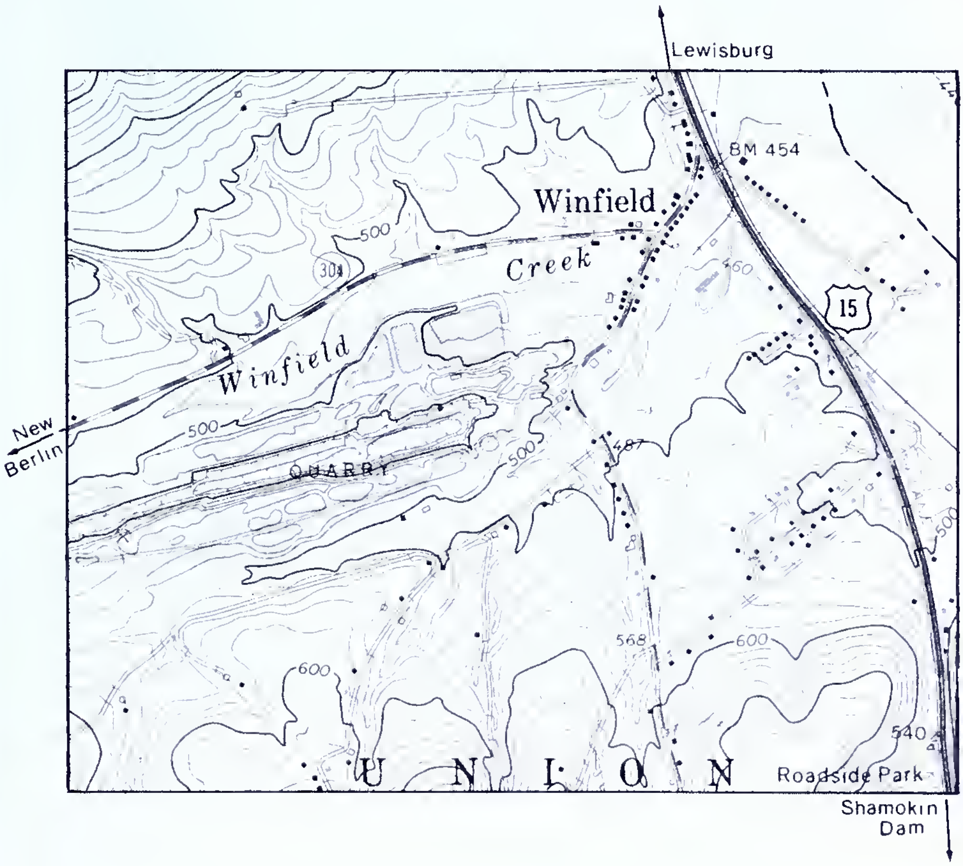
NOTES

FAYLOR-MIDDLECREEK LIMESTONE QUARRY AT WINFIELD

LOCATION

The Faylor-Middlecreek quarry at Winfield on Pa. Route 304 is located 0.7 mile southwest of the village of Winfield in Union Township and midway between the traffic circle at the junction of U.S. Routes 11 and 15 west of Sunbury and the borough of Lewisburg. The quarry is owned and operated by Faylor-Middlecreek, Inc. The entrance to the quarry and the quarry workings may be found in the southwest rectangle of the Northumberland quadrangle.

Mineral collecting is permitted only by organized mineral clubs that make advance arrangements on one day each year. The company conducts an "Open House" in the quarry site at



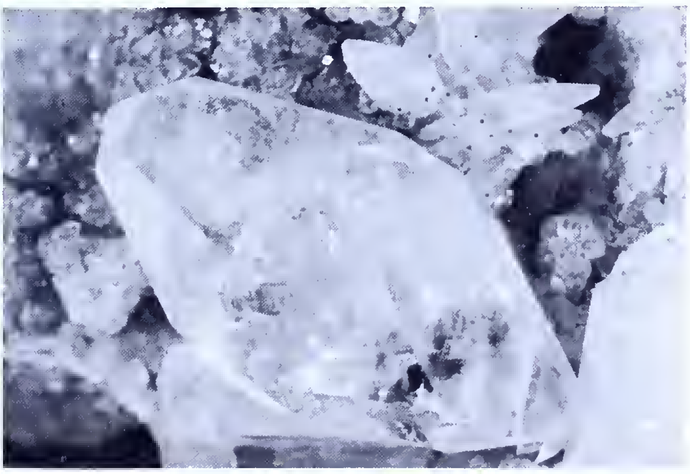
this time. Safety personnel from the company are on duty and a small donation from each club member is suggested in order to defray expenses incurred. Each group entering the quarry must provide their own safety equipment (hard hats, shoes, goggles) and sign the release register at the entrance. At no time is this "Open House" extended to the general public.

Tuft of tiny strontianite crystals from Winfield

MINERALS

- Anglesite
- Barite: uncommon; white cleavages in calcite
- Cacoxenite: yellow needle crusts and red fibrous to mammillary veins; associated with "limonite"
- CALCITE: in vugs; nailhead and scalenohedral crystals; white
- CELESTINE: blue to almost clear, colorless crystals in vugs and vein seams up to ½ inches long; some lightly etched
- Dolomite: rhombic crystals and cleavages; may be pinkish to white

FLUORITE: purple-pink cleavages; crystals rare; in calcite
Galena: cubes up to ¾ inch on a cube edge are rare; cleavages in veinlets; rare cuboctahedrons
Goethite: "limonite"
Greenockite: rare; bright yellow stains near weathered sphalerite
Gypsum: brown crystals, 2-3 mm in length
Halotrichite: uncommon; white, hair-like tufts, as an incrustation with gypsum
Pyrite: highly modified cubes and pyritohedrons in white calcite; also granular-massive
Quartz: massive vein material; rarely radial crystal clusters with etched faces; smokey crystals
Smithsonite
Sphalerite: small, dark to lemon yellow; massive and crystals, usually striated; with calcite and galena; lower iron variety is orange-brown; usually in cleavages
Strengite(?): associated with "limonite"
STRONTIANITE: clusters of small, white radiating crystals; some "calciostrontianite" sheaves and crystals
Vivianite: rare; deep blue microcrystals associated with limonite



Large calcite crystal and smaller celestine crystals from Winfield

GEOLOGY

The Winfield quarry is located on the south limb of the Berwick anticline. From north to south, quarrying has exposed limestones of the Upper Silurian Tonoloway Formation and Silurian-Devonian Keyser Formation, and the Devonian Helderberg Formation.

Vugs and solution channels have been the site of deposition for the carbonate minerals like strontianite, dolomite, and calcite. Other minerals, such as fluorite, sphalerite, and galena represent a different mode of crystallization from a source at depth by means of heated (hydrothermal) solutions. In part, sphalerite and galena are replacing pyrite-bearing, laminated limestone. This type of mineralization is most common near the contact of the Keyser limestone with the Tonoloway limestone, but within the Tonoloway (northern third of the quarry).

SIMILAR OCCURRENCES

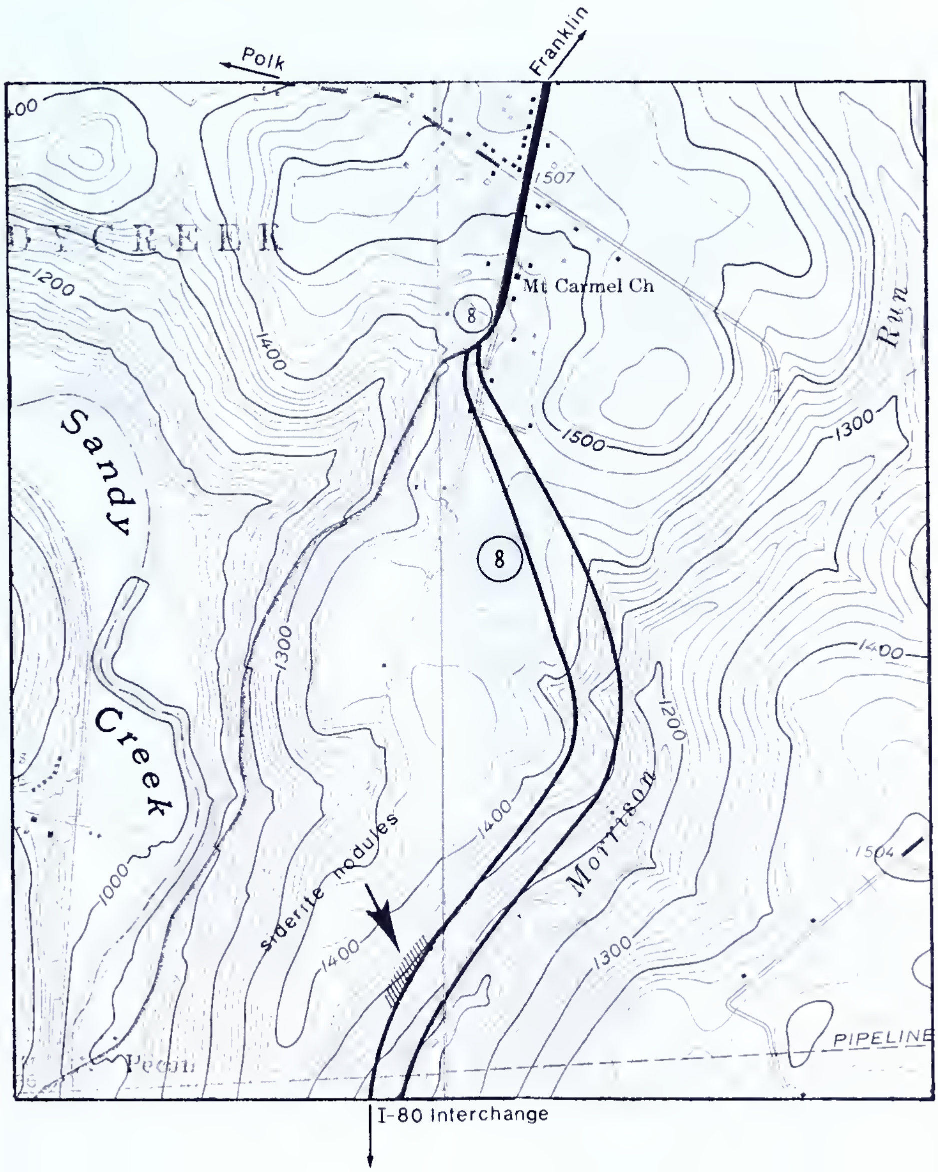
East Salem, Juniata County; Lime Bluff, Lycoming County; Meckley's quarry, Northumberland County; Faylor-Middlecreek quarry at McVeytown, Mifflin County; and Allenport, Huntingdon County.

NOTES

FRANKLIN SIDERITE NODULE LOCALITY

LOCATION

This roadcut is located on Pa. Route 8 south of the city of Franklin. It is on the west side of the southbound lane of the divided highway, 3.4 miles south of the intersection of Pa. Route 8 with the road to Franklin Area High School, and 1.5 miles south of Mount Carmel Church in Sandycreek Township, just west of the boundary between the Polk and Kennerdell quadrangles, on the Polk quadrangle. Caution should

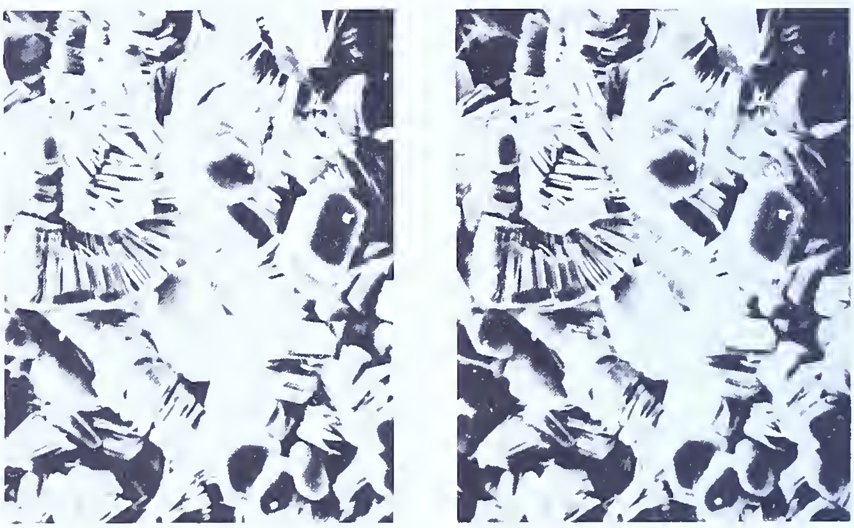


be exercised in collecting along this busy highway. Vehicles must be pulled well off the highway.

MINERALS

Barite: small masses in cavities; some groups of clear, prismatic crystals with highly modified terminations

Dickite: kaolinite group; (a clay mineral) blebs and coatings on all other minerals; bone white; very pure



Scanning electron photomicrograph stereo pair of dickite from the Franklin locality

Gypsum: groups of small crystals as cavity linings

Hematite(?)

Kaolinite group: see dickite

Pyrite: brassy-yellow cubes, some modified by octahedral and pyritohedral faces; possibly some alteration to goethite

Quartz: small, doubly terminated crystals; some with a thin, yellow coating of iron-stained clay

SIDERITE: round to oval, gray to reddish-brown nodules up to 4 to 6 inches; also as pale to dark golden-yellow crystals and drusy coatings lining openings in the nodules; crystals have distinctive rhombohedral step-growth habit; sometimes coated with dark red to brown hematite(?) and/or goethite

Sphalerite: massive dark brown to black vein fillings with good cleavage; some transparent dark yellowish-brown crystals

GEOLOGY

The collectable minerals at this site occur in shrinkage cracks in the siderite nodules and lenses. The siderite formed under marine conditions at the time of deposition of the enclosing sediment. The minerals were deposited or precipitated in the nodules and lenses either during or after lithification of the surrounding sediment to shale. The nodules and lenses are present in a bed of grayish-black shale of the Mississippian Cuyahoga Formation.

SIMILAR OCCURRENCES

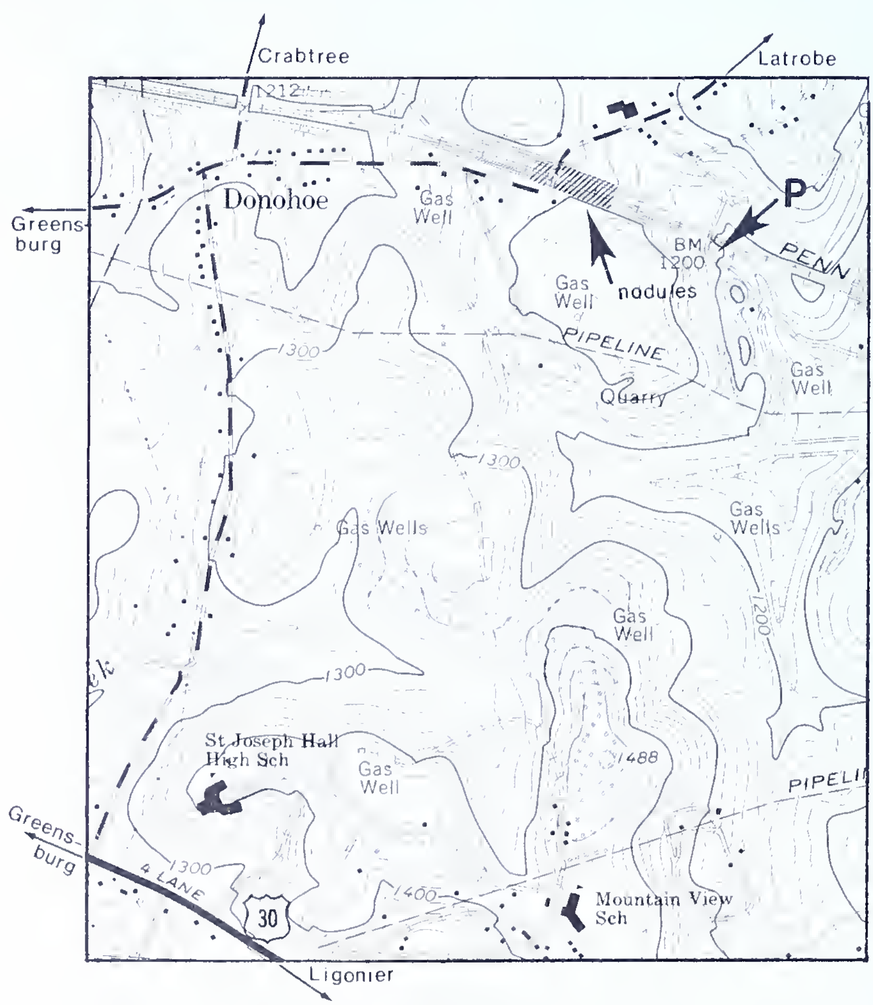
Wittmer, Allegheny County; East Unity Church and Sedwicks Mill, Butler County; Shelocta, Indiana County; Sugar Hill, Jefferson County; Donohoe, Westmoreland County.

NOTES

DONOHOE WURTZITE LOCALITY

LOCATION

The Donohoe locality, in Unity Township on the Latrobe quadrangle, is best reached via the road from Greensburg to Latrobe by turning onto a secondary road 0.8 mile east of the main intersection at Donohoe. Park off this secondary road just south of the railroad tracks ("P" on map) and walk 0.3 mile (about 1,600 feet) west along the track to the area near the high-level highway bridge. Note that this is a main line of the Penn Central Railroad, from whom permission must be obtained, and that caution must be observed at all times. Hard hats are essential.



MINERALS

Barite: clear, colorless, tabular cleavages
Calcite: common; brown; fibrous
Chalcopyrite: uncommon;brassy-yellow blebs with barite
Pyrite: small, brassy-yellow grains
SIDERITE: nodules 1 to 2 inches across
Sphalerite: dark brown, paper thin plates in calcite
Wurtzite: reddish to golden-brown hexagonal prisms and pyramids; forms radiating clusters; some with bulb-like terminations on the large end

GEOLOGY

The collectable minerals at Donohoe are in contraction cracks in siderite nodules in the Glenshaw Formation of the Pennsylvanian Conemaugh Group, above the Brush Creek limestone. The nodules formed under marine conditions. The minerals within the nodules were precipitated from solution at a later time, probably during or after lithification of the enclosing sediment.

SIMILAR OCCURRENCES

Wittmer, Allegheny County; East Unity Church and Sedwicks Mill, Butler County; Shelocta, Indiana County; Sugar Hill, Jefferson County; Franklin, Venango County.

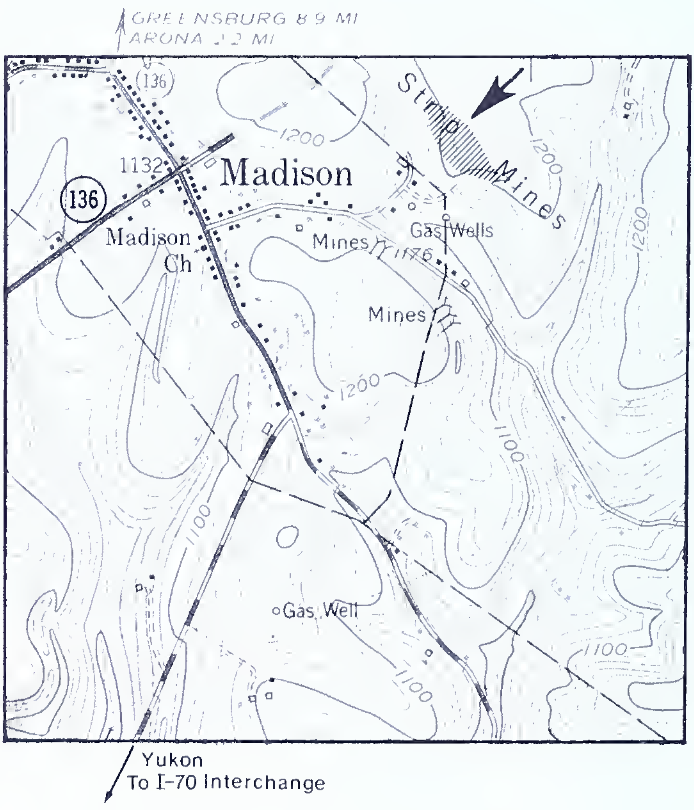
REFERENCE

Seaman, D. M. and Hamilton, Howard (1950), *Occurrence of polymorphous wurtzite in western Pennsylvania and eastern Ohio,* Am. Mineralogist, v. 35, p. 43-50.

MADISON PICKERINGITE LOCALITY

LOCATION

This locality is just east of Madison in Hampfield Township, on the Smithton quadrangle. It can be reached by turning east 0.1 mile south of the main intersection in Madison. Proceed 0.2 mile, then turn left. After 0.1 mile turn right onto a dead end unpaved road, park and walk the remaining distance into the abandoned strip mine.



MINERALS

Goethite: "limonite" pseudomorphs after pyrite

PICKERINGITE: fine, grayish-white hair-like crystals up to ⅛ inch long; silky aggregates and mammillary masses as vein fillings and as coatings

Pyrite: spherical to oval concretions in sandstone

GEOLOGY

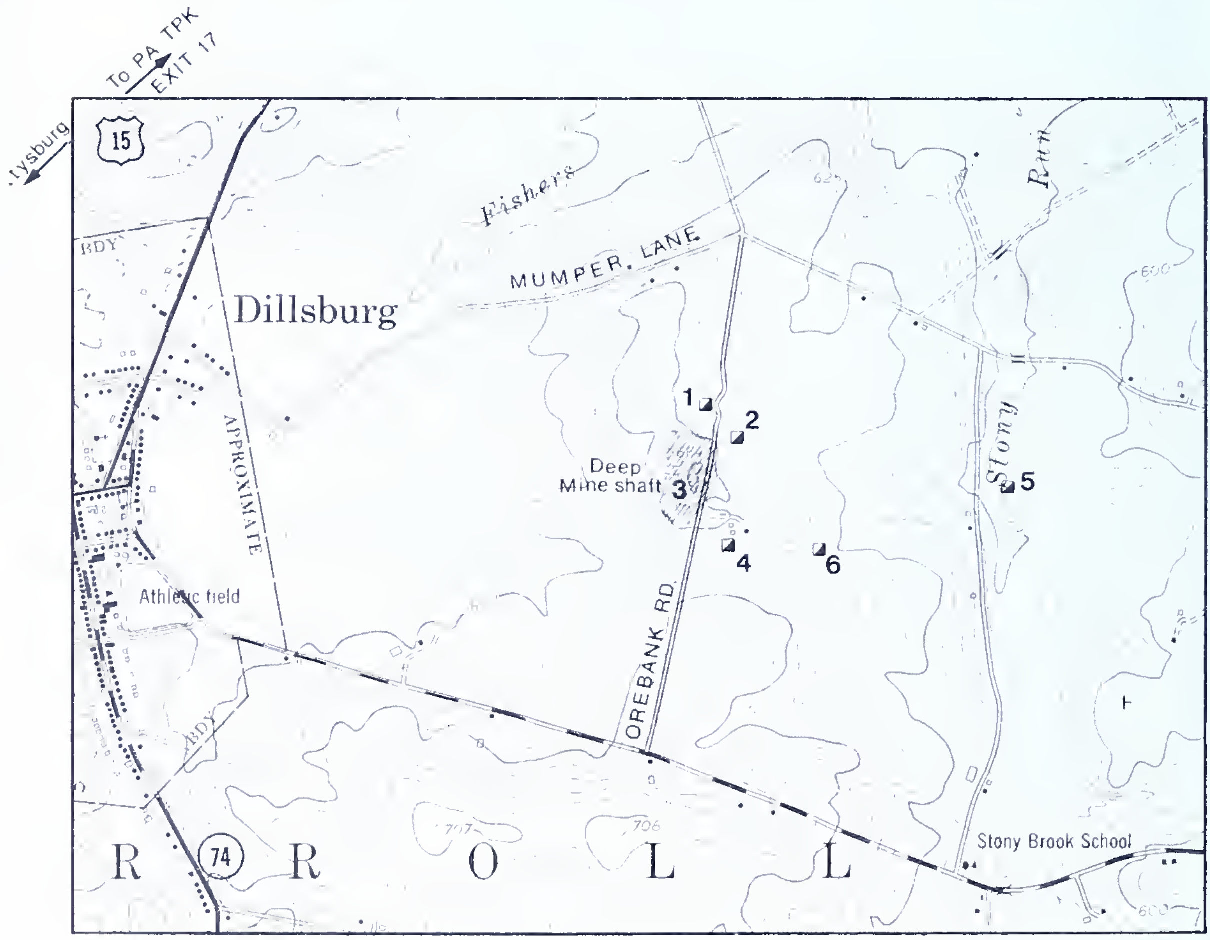
The goethite and pickeringite form from the alteration of pyrite in bedrock of the Pennsylvanian Conemaugh Group. Ground water, probably containing magnesium and aluminum in solution, seeps through the bedrock and comes into contact with the pyrite (iron sulfide). The pyrite is oxidized to form goethite (iron hydroxide) as "limonite" pseudomorphs that retain the external form of the pyrite. The sulfur from the pyrite goes into solution in the ground water. In the strip mine at Madison the ground water slowly emerges and evaporates, allowing the growth of crystals of pickeringite (hydrated magnesium aluminum sulfate).

NOTES

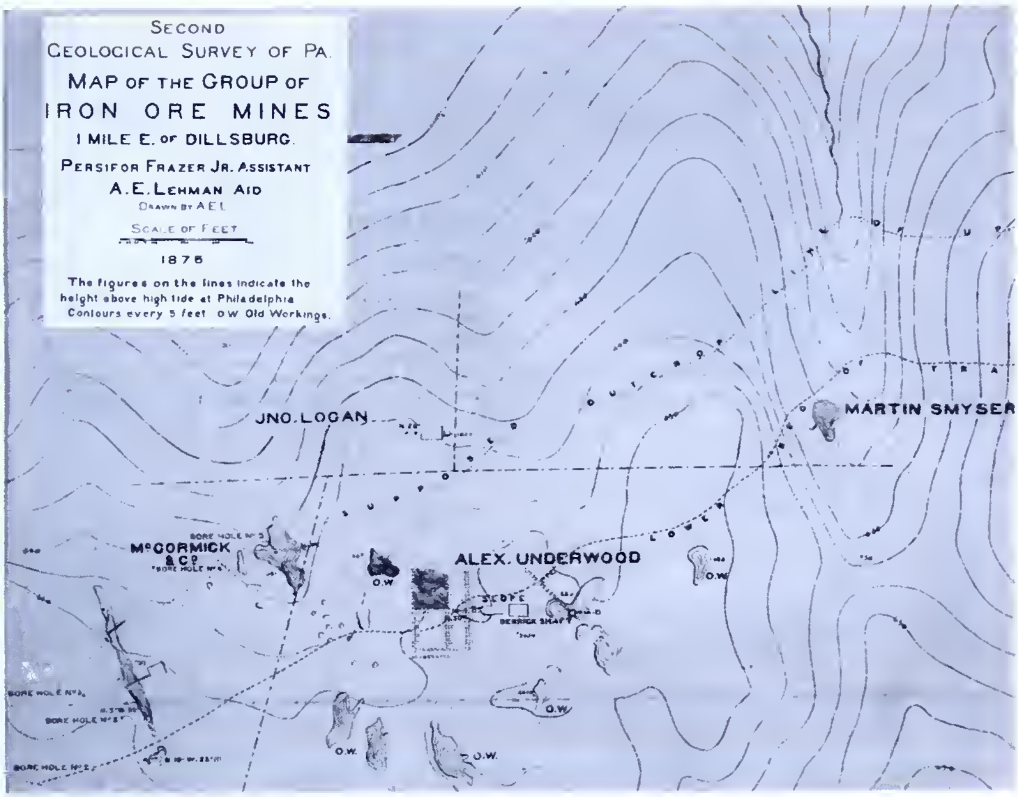
DILLSBURG IRON MINES

LOCATION

One mile east of Dillsburg, iron ore was taken from more than 30 open pits and underground mines over a zone about 1.5 miles long and from 0.25 to 0.50 mile wide. The remains of these mines and pits are along Orebank Road (between Mumper Road and the Dillsburg-Rossville road) in Carroll Township in the Dillsburg quadrangle. Collecting is good from the old railroad bed in the vicinity of the Longnecker



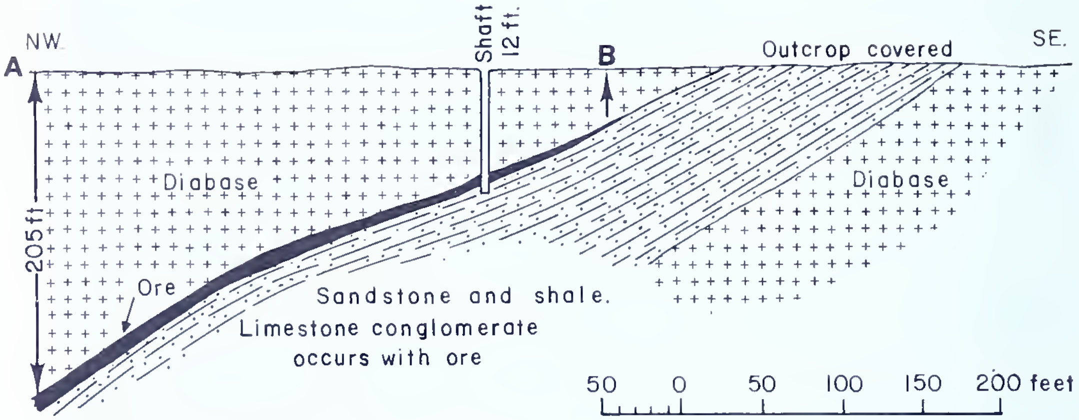
1. McCormick 2. Longnecker (shaft) 3. Underwood (shaft) 4. Smyser 5. Jauss 6. Altland



mine. Many different property owners are involved in the total area, so that permission to collect from different sites will involve obtaining permission from more than one landowner.

MINERALS

Apatite group: species unknown, possibly the hydroxyl or carbonate species as white hexagonal prisms
Calcite: white cleavages
Chalcopyrite: massive; brassy yellow
Chlorite group: species unknown; good, bluish-green hexagonal crystals
Datolite: small, clear, white, glassy grains
Hematite: specular
MAGNETITE: massive; platy
Malachite: green stains and coatings
Muscovite: lilac colored, possibly from manganese



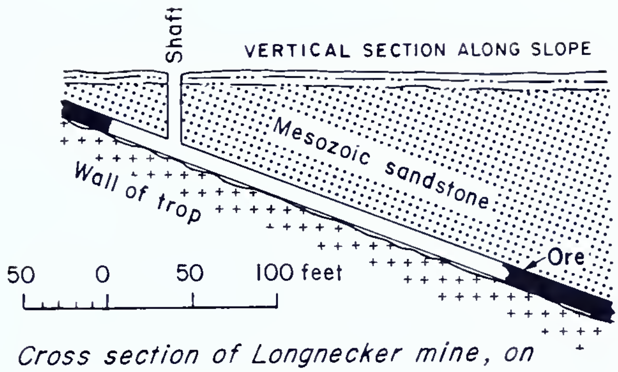
General structure section at Jauss mine, near Dillsburg.

ORTHOCLASE: salmon-colored crystals; probably an iron-bearing variety
PYRITE: small cubes

GEOLOGY

The Cornwall-type iron bodies near Dillsburg were formed by the replacement of limestone conglomerate beds within the Triassic Newark Group. Magnetite and other minerals precipitated from hot solutions associated with the intrusion of diabase. The diabase sheets were intruded roughly parallel to the limestone conglomerate and directly in contact with these rocks. However, in some locations the limestone conglomerate beds alternated with red sandstone and shale beds and the diabase is in direct contact with sandstone and shale. Cross-sections through several mines show these relationships: (cross-sections taken from reports of Frazer and Spencer).

Over a sixty year period (1828-1888), the mines yielded almost 1.5 million tons of iron ore. The most productive part of the Dillsburg iron ore field was the Underwood tract and portions of the McCormick property. On the Underwood tract, there were five large open pits and four deep mines. These have been abandoned since 1887. The largest mine on the property was known as the Underwood Slope and approximately 25,000 tons of ore, averaging 40% iron, were removed.



Cross section of Longnecker mine, on Logan tract, Dillsburg.

REFERENCES

Frazer, Persifor, Jr. (1877), *1875 report of progress in the counties of York, Adams, Cumberland and Franklin; the Dillsburg group of mines*, Pa. Geol. Survey, 2nd ser., Rept. CC, p. 207-239.

Spencer, A. C. (1908), *Magnetite deposits of the Cornwall type in Pennsylvania,* U.S. Geol. Survey Bull. 359, p. 71-96.

NOTES

KLINE'S QUARRY — ANATASE AND PYRITE LOCALITY

LOCATION

Kline's quarry is located 0.55 mile south of the west end of the old (Pa. Route 462) Columbia-Wrightsville bridge in Wrightsville in the Columbia West quadrangle. From Hellam Street (Lincoln Highway or Pa. Route 462 west of town and Chestnut street in Columbia) turn south onto Pa. Route 624 (2nd Street) then left on Orange Street for one block and finally right onto South Front Street. The quarry is located on the east side of Pa. Route 624 (South Front Street) just across Kreutz Creek.

This is an active quarry and, although neither clubs nor individuals are encouraged, mineral collecting by individuals is sometimes permitted on Saturday morning (the gate is locked at noon). Local clubs wishing to apply for a Sunday trip should seek permission from the owners at P.O. Box 131, Wrightsville, Pennsylvania 17368. At times, collecting may be rather poor. The following rules and regulations apply:

1) Hard hat, safety goggles, and steel-toed shoes must be worn and supplied by each person.
2) Release form must be signed.
3) Collecting not recommended during heavy rains.
4) Payment of a fee to cover an employee's expenses while on duty at the time the club arrives and during the time the group is collecting. This applies only to club trips on Sunday.
5) Advanced permission must be sought by clubs for Sunday trips. This does not apply to individuals seeking permission on a Saturday morning.

MINERALS

Albite: small, prismatic, white crystals dusted with pyrite; cleavages

Anatase: small, blue crystals (dipyramids with variable development of basal pinacoid) and tabular blue plates intergrown with brookite, both replacing ilmenite

Aragonite(?)

Biotite(?)

Brookite: small, tabular, striated golden-brown crystals

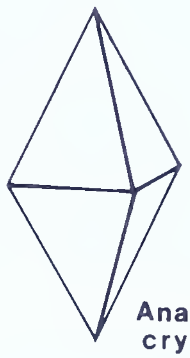
Calcite: small, good crystals of several habits

Chalcopyrite: brass-yellow blebs up to ½ inch in milky quartz with galena and pyrrhotite

Chlorite group: species unknown; small balls of greenish flakes and a dark green coating on several vug minerals

DOLOMITE: white crystals; excellent pink crystals available at times from the lower, dolomite rock quarry

Galena: bright, silvery cleavages up to ¾ inch in milky quartz; some have an octahedral cleavage or parting similar to some of the galena from Pequea
Goethite: reported
Graphite



Anatase crystal

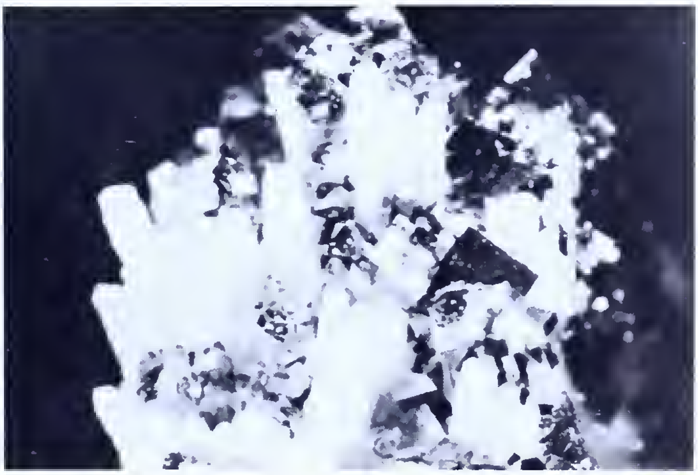
Hematite: thin, hexagonal crystals with chlorite
Ilmenite: flat, black plates and crystals up to 1 inch
Marcasite: dull, brassy masses up to 1 inch in crystalline quartz
Monazite: small, gemmy, golden tabular crystals; exhibit an emerald-green color with unfiltered, short wave ultraviolet light
Muscovite: only as small flakes in the dolomite rock
Orthoclase: var. adularia; reported by Montgomery (1973)
PYRITE: cubes, elongated cubes, and concentric radiating masses(?) in rock dolomite; cubes modified by octahedral faces in vugs and phyllite; also as a beautiful, iridescent dusting on calcite crystals
Pyrrhotite: masses up to a few inches, blebs with chalcopyrite and galena in milky quartz; rare crystals with galena up to ¾ inch but usually laying down
Rutile: reported by Montgomery (1973)
Sphalerite: dark, golden-brown with pyrite in rock dolomite; reddish to dark golden-brown films on fractures and crystals in open vugs with quartz and albite

GEOLOGY

The lower quarry is in the Cambrian Vintage dolomite. Except for occasional, excellent pink dolomite crystal groups, this quarry has little to offer collectors. The upper quarry is in the Cambrian Harpers quartzose phyllite. The phyllite itself sometimes yields fair pyrite cubes up to ½ inch. The most interesting minerals occur along the outer margins of the milky quartz pods in the phyllite (a metamorphic rock with a sheen on the chlorite-muscovite-rich cleavage surfaces). This is where the sulfides and larger anatase crystals occur. Interesting minerals can be found in almost any piece of vuggy Harpers phyllite from this locality.

REFERENCE

Montgomery, Arthur (1973), *Pennsylvania minerals nos. 129 and 130,* Mineralogical Society of Pa., Keystone Newsletter, v. 22, nos. 9 and 10.

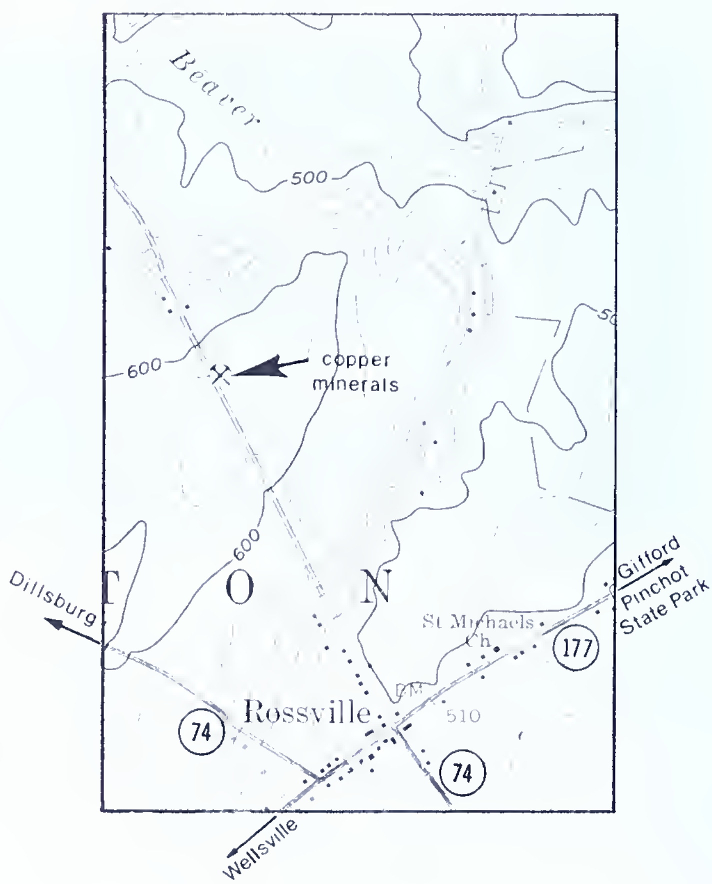


Pyrite cubes on prismatic albite crystals from Kline's quarry

ROSSVILLE AZURITE AND MALACHITE LOCALITY

LOCATION

The Rossville copper mineral occurrence is located along the unnumbered highway from Rossville to Dillsburg through Stevenstown about 0.7 mile northwest of Rossville (highway survey point 364 + 90). The best minerals occur on the northeast side of the road cut but some copper minerals were also present on the southwest side (highway survey point 365 + 51). This occurrence is in Warrington Township in the Wellsville quadrangle. The road is heavily traveled so one should be cautious and park well off the pavement and shoulder onto the wide swale.



MINERALS

Actinolite: greenish veinlets in hornfels

Anorthite-bytownite: white; crystals, ¼ to ½ inch phenocrysts in fine-grained diabase in the same road cut closer to Rossville

AZURITE: common; beautiful blue crystalline coatings on fractures with malachite

Bornite: small, orange, metallic blebs tarnishing rapidly to peacock blue; intergrown with chalcocite

Chabazite: small, white crystals

Chalcocite: small, gray-blue, metallic blebs intergrown with bornite

Chalcopyrite: small, brass-yellow blebs in hornfels

Chrysocolla: bluish-green coatings on fractures

Digenite: small, blue-gray blebs in hornfels with chalcocite; often rimming chalcopyrite or bornite and in turn rimmed by chalcocite

Epidote: pistachio-green crystalline coatings

Garnet group: probably the species grossular; golden masses and crude crystals; not directly associated with copper minerals

Hematite

Heulandite: small, clear crystals

Idaite(?): reported, "orange bornite"; identified only by appearance with an ore microscope

Magnetite: finely disseminated

MALACHITE: common; green coatings with azurite on fractures in hornfels

Stilbite: good, yellow-orange crystals in veins

GEOLOGY

The copper mineralization at Rossville occurs in hornfels; once a shaly rock but now baked to nearly porcelain-like masses by a Triassic diabase sheet around and beneath the hornfels. The diabase may now be observed as extremely hard rock in the same road cut nearer Rossville as float boulders to the north or west. Hydrothermal solutions from the crystallizing diabase formed chalcopyrite in the more calcareous (limy) layers of hornfels. As the hydrothermal solutions became richer in copper, the chalcopyrite was gradually converted first to bornite, then to digenite, and finally to chalcocite, the richest possible copper sulfide. Recent, near-surface ground waters converted some of the copper sulfides into the beautiful azurite and malachite coatings for which this locality is known. This occurrence is somewhat similar to Cornwall-type iron-copper deposits; however, at Rossville the host rock is less limy and copper is more abundant than iron. Similar to Cornwall, traces of gold and silver occur in the sulfides. At Rossville, the main 14 inch thick bed contains 2.07% copper but only 0.03 oz. gold/ton and 0.3 oz. silver/ton. Such rock can only be mined where it occurs in enormous quantities.

SIMILAR OCCURRENCES

Teeter quarry, Adams County; Kibblehouse quarry, Montgomery County; and numerous old prospects in Bucks County.

REFERENCE

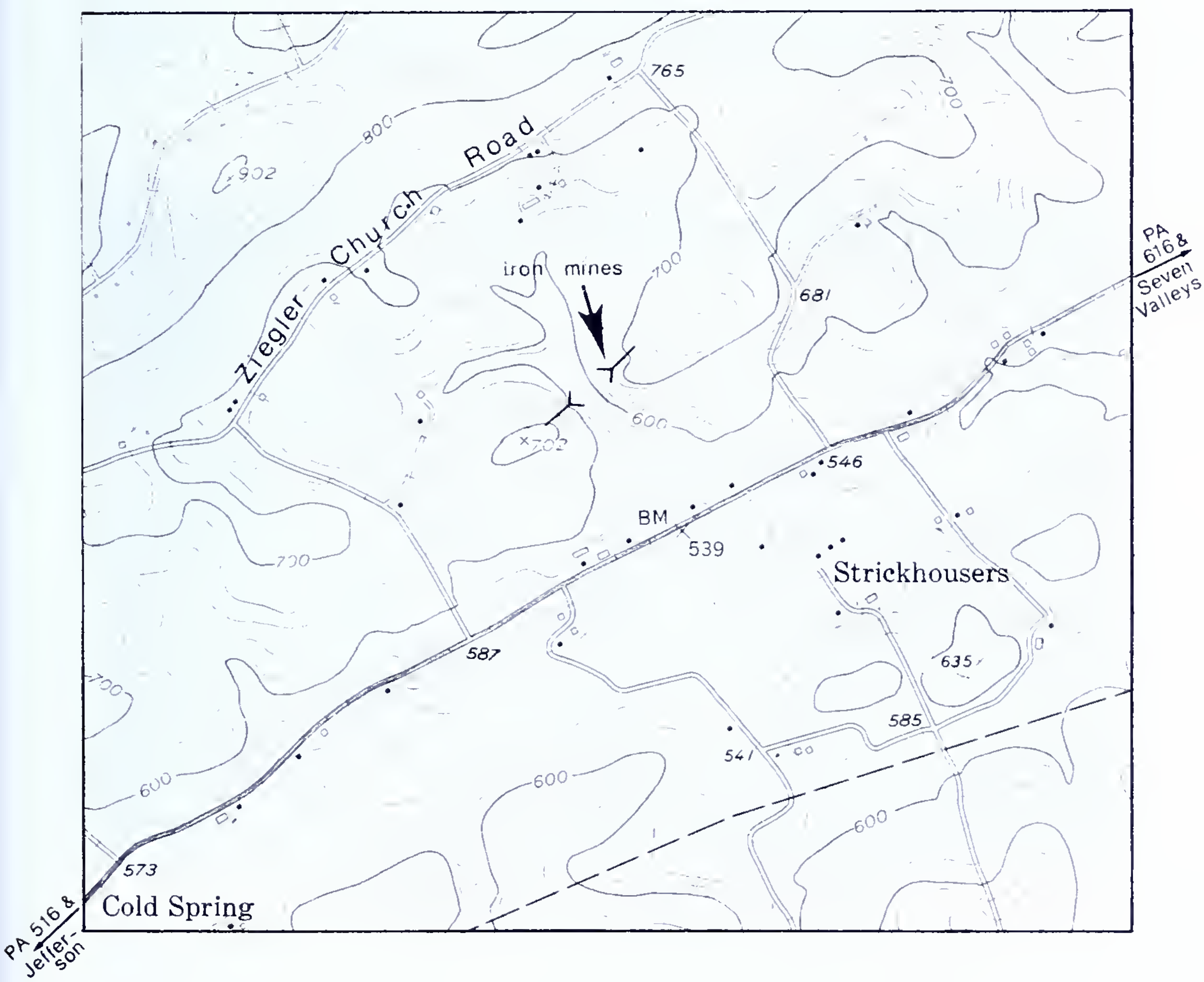
Smith, R. C. II and O'Neill, B. J. (1973), *A new Triassic copper occurrence at Rossville, Pennsylvania,* Pennsylvania Geology, v. 4, no. 1, p. 6-7.

NOTES

STRICKHOUSERS IRON MINES

LOCATION

The Strickhousers, Codorus, or York Iron Company mines are located just above creek level in a gap 0.5 mile northwest of the village of Strickhousers in North Codorus Township. This area is about halfway between Jefferson and Seven Valleys (Seven Valleys quadrangle). It is best entered by turning south on a lane from Ziegler Church Road (on the north) at the Goodling house. Permission must be obtained from the owner, Sunnyside Farms. The best collecting is on the east side of the gap and north of the adit. Dumps also occur at the adit on the west side. WARNING: the adits are unsafe and should not be entered.



MINERALS

HEMATITE: specular variety in gray, micaceous masses, shiny plates with quartz up to ¾ inch

MAGNETITE: sharp octahedrons up to $^{3}/_{16}$ inch in hematite and phyllite

Quartz: milky veins

GEOLOGY

Stose and Jonas (1939) mapped the host rock as Cambrian Harpers phyllite (phyllite being a metamorphic rock intermediate between slate and mica schist). Socolow (1974) mapped three zones of specular hematite up to 80 feet thick. The belt of ore float was followed along strike for about 3000 feet.

The Strickhouser mine was opened in 1854 and about 10 to 20 tons of ore were mined per day by 12 to 25 miners. It produced ore containing about 35% iron for at least 15 years.

Entrance to eastern Strickhouser mine.

Hand specimen of specular hematite from the Strickhouser mine. Arrow indicates magnetite octahedron.

REFERENCES

Frazer, Persifor, Jr. (1876), *York and Adams Counties,* Pa. Geol. Survey, 2nd ser., Rept. C, p. 20-22.

Socolow, A. A. (1974), *Geologic interpretations of aeromagnetic maps of southeastern Pennsylvania,* Pa. Geol. Survey, 4th ser., Inf. Circ. 77, p. 80-83.

Stose, G. W. and Jonas, A. I. (1939), *Geology and mineral resources of York County,* Pa. Geol. Survey, 4th ser., County Rept. 67, 195 p.

MUSEUMS IN PENNSYLVANIA DISPLAYING ROCKS AND MINERALS

NOTE: The exhibit hours and entrance fees listed below are as of August 1975, and are subject to change.

Allegheny College, Department of Geology, Meadville.
A small display of rocks and minerals in hall cases.

Audubon Shrine Museum, Phoenixville.
Collection of minerals from the Ecton mine, and copper minerals from the area.

Baldwin-Reynolds House Museum, 848 N. Main St., Meadville.
Small collection of minerals; Halver W. Getchell, Curator; open June through August, Wednesday, Saturday and Sunday 2-5; adults 50¢; childern 25¢; school groups no charge; closed November through May.

Blair County Historical Society, Altoona.
A small collection of minerals in the Baker Mansion; Elwood S. Clouse, Curator; open June 1 through November 30, 1:30 to 4:30, Thursday, Friday, and Saturday; adults $1 (10 or more in group is 75¢ per person), children under 16, 25¢; no charge for members.

Bradford County Historical Society, Court Street, Towanda.
A collection of minerals and fossils from the Second Geological Survey of Pennsylvania (1874-1887).

Bryn Mawr College, Mineral Museum, Department of Geology, Bryn Mawr.
The minerals are displayed in a large room and in cases throughout the hall; includes the George Vaux and Rand collections. Dr. M. L. Crawford, Curator; by appointment only.

Carnegie Museum, Carnegie Institute, 4400 Forbes Avenue, Pittsburgh.

Rocks and minerals as well as displays on geology; includes the Jefferis collection; D. L. Oswald, Assoc. Curator for Minerals; open Tuesday through Saturday 10-5; Sunday 12-6; suggested donation $1 adults and 50¢ minors; closed national holidays.

Chester County Historical Society, 225 North High Street, West Chester.

Includes the Brinton, Gay, McKinstry and Rose mineral collections; Travis Coxe, Director; open Monday and Tuesday 1-5; Wednesday 1-9, Thursday and Friday 10-5; no charge; closed August, Labor Day, holidays, Saturdays and Sundays.

Connellsville Area Senior High School, Connellsville.

A worldwide assortment of rocks, minerals, and fossils; includes part of the Stillwagon collection; Mary E. Floto, Instructor in charge of the collection; open September through May, Monday through Friday from 8-3, June through August, Monday through Friday from 9-4; free.

Cornwall Furnace, Pennsylvania Historical and Museum Commission, Cornwall.

Minerals from the famous adjacent Cornwall Mine.

Delaware County Institute of Science, 13 South Avenue, Media.

Rocks and minerals including Delaware County minerals; free; open Mondays, day and evening, other days by appointment.

Dickinson College, Carlisle.

Mineral collection is in the basement of the Althouse Science Building; a fluorescent collection is separately displayed in a small room.

Erie Public Museum and Planetarium, 356 W. Sixth Street, Erie.

A small, general collection of minerals; Alexander O. Clemente, Director; open Tuesday through Saturday 10-5, Sunday 2-5; no charge; closed Mondays and national holidays.

Everhart Museum of Natural History, Science and Art, Nay Aug Park, Scranton.
Small collection of rocks and minerals on display; the Brooks model coal mine is adjacent to the museum; William Speare, Assoc. Director and Curator; open Tuesday through Saturday 10-5, Sunday 2-5; no charge; closed New Year's, Thanksgiving, and Christmas.

Franklin Institute Science Museum & Planetarium, 20th St. and Benjamin Franklin Pkwy., Philadelphia.
A small collection of minerals; Joel N. Bloom, V. P. and Director of the Science Museum; open Monday through Saturday 9-5, holidays 10-5, Sunday 12-5; adults $1.50, children $1, under 5 no charge; special group rates for 10 or more; closed New Year's, July 4th, Labor Day, Thanksgiving, Christmas Eve and Christmas.

Gilman Museum, Lost Cave, Hellertown.
Collection includes mineral specimens and gems in room and hallway leading to cave entrance and shop; Erwin C. Gilman, Director and Curator; open daily 9-9; no charge for viewing displays.

Lafayette College, Department of Geology, Van Wickle Hall, Easton.
A display of minerals throughout the hallways and a research and teaching collection.

Lehigh University, Department of Geology, Williams Hall, Bethlehem.
Several large display cases with rocks, minerals, and fossils on exhibit at all times.

Merrick Art Gallery, 5th Ave. and 11th Street, New Brighton.
A small mineral display; Robert Merrick, Trustee; open 10-5 weekdays, except Monday; free.

North Museum, Franklin and Marshall College, College and Buchanan Avenues, Lancaster.
A collection of local Lancaster County minerals and fossils; Leonard J. Duersmith, Curator of Geology and Mineralogy; open September through June, Wednesday through Saturday 9-5, Sunday 1:30-5:00; July through August, Saturday and Sunday 1:30-5:00; no charge; closed New Year's, Easter, and Christmas.

Pennsylvania State University, College of Earth and Mineral Sciences Museum, University Park.
An extensive collection of minerals, rocks and fossils displayed in a large room and the halls of the Mineral Industries Building; contains the Genth collection; David E. Snell, Curator; open Monday through Saturday 9-5, Sunday 1-5; no charge; closed weekends of New Year's, Memorial Day, July 4th, Labor Day, Christmas, Easter Sunday, and Thanksgiving.

Philadelphia College of Pharmacy and Science, 43rd and Kingsessing and Woodland Avenues, Philadelphia.
A small collection of minerals is displayed on the third floor of the college building.

Philadelphia Academy of Natural Sciences, 19th Street and Benjamin Franklin Parkway, Philadelphia.
Collection of minerals from the Commonwealth including notable specimens collected by Samuel G. Gordon, and one of the earliest mineral collections in America, the Adam Seybert collection; open Monday through Saturday 10-5, Sunday 1-5; adults $1, children 50¢; group rates; closed New Year's, Labor Day, Thanksgiving, and Christmas.

Pierre and Cliffs Mineral Museum, Rt. 19, Zelienople.
A small, general collection of rocks and minerals.

Radnor Historical Society, 113 W. Beech Tree Lane, Wayne.
A small collection of minerals; Mrs. D. H. Therman, President; open Tuesday 2-5, other times by appointment; no charge.

Reading Public Museum and Art Gallery, 500 Museum Road, Wyomissing.
Mineral, fossil, and gem collection; Fritz Island collection includes outstanding specimens of zeolites; fossil collection includes a sabertooth tiger skull from the Port Kennedy cave, dinosaur foot tracks from Schwenksville, and Cambrian trilobites from Fruitville near Lancaster; B. Charles Elliot, Jr., Director; open September through May, Monday through Friday 9-5, Saturday 9-12, Sunday 2-5; June through August, Monday through Friday 9-5, Sunday 2-5; no charge; closed New Year's, Good Friday, Memorial Day, July 4th, Election Day, Thanksgiving, and Christmas.

Reading School District Planetarium, 1211 Parkside Drive South, Reading.
Collection includes meteorites; Bruce L. Dietrich, Director; open Monday and Tuesday, Friday 9-4, Wednesday and Thursday 9-4 and 7-9, Sunday 2-4; adults $1, children and students 75¢, closed August and national and state holidays.

Stillwagon Free Rock Museum, Connellsville.
Fluorescent minerals are a speciality; fossils and Indian artifacts are also displayed; no charge.

St. Vincent College Museum, Latrobe.
A large collection of U.S. and European minerals.

Tioga Point Museum, 724 S. Main Street, Athens.
A small display of minerals and other geological material.

University of Pennsylvania, Department of Geology, College Hall, Philadelphia.
A small collection of rocks and minerals.

University of Pittsburgh, Department of Earth & Planetary Science, Pittsburgh.
A display of minerals in hall cases.

Wagner Free Institute of Science, Montgomery Ave. and 17th Street, Philadelphia.
Permanent exhibits of fossils and minerals and a large study collection of Pennsylvania minerals.

Waynesburg College, Waynesburg.
A small mineral collection in their museum.

West Chester State College, Science Museum, Anderson Hall, West Chester.
A representative display of Pennsylvania minerals, including gifts from the Sharpless, Darlington, and other collections; also minerals found in the Chester County area; Dr. Seymour Greenberg, Professor in charge of geological collections; open Monday through Friday 8-5, Saturday 8-12; no charge; closed academic holidays.

William Penn Memorial Museum, Pennsylvania Historic and Museum Commission, 3rd and North Streets, Harrisburg.
A mineral display gallery; Donald Hoff, Earth Science Curator; open Monday through Saturday 9-5, Sunday 1-5; no charge; closed New Year's, Christmas, and election days.

Wilmar Lapidary Museum, 232 and Pineville Rd., Bucks County, Pineville.
Mineral specimens and mineral carvings; Dr. William Kuhlman, Director; open Tuesday through Saturday 10-5, Sunday 1-5; admission 50¢; special group rates; closed Mondays, New Year's and Christmas.

Wyoming Historical and Geological Society, 69 S. Franklin Street, Wilkes-Barre.
A small, general collection of minerals; Ralph L. Hazeltine, Director; open Tuesday through Saturday 10-5; no charge; closed Sundays, Mondays, and all national holidays.

York County Historical Society, 225 E. Market Street, York.
The museum has a small, general collection of minerals, rocks and fossils.

PENNSYLVANIA MINERAL CLUBS

NOTE: The officers, addresses, and meeting dates listed below are as of August, 1975.

Beaver County Rock & Mineral Society
Meeting: Steffen Hill School, Beaver Falls; 3rd Tuesday each month; 7:30 p.m.

Berks Mineralogical Society
Meeting: Reading Public Museum, Wyomissing; 2nd Tuesday each month, except July and August; 8:00 p.m.

Blair Rock and Mineral Club
Meeting: Logan Hills Community Center, Altoona; 4th Tuesday each month; 7:30 p.m.

Bucks County Earth Science Society, Inc.
Meeting: Fidelity Bank, Southampton; 2nd Monday each month; 8:00 p.m.

Bucks County Gem Cutters Guild
Mrs. Brant G. Adams, President
Woodwinds, 1776, Sugar Road, Solebury, Pa. 18963

Bux-Mont Mineral and Lapidary Club
George Dzombach
Spring Valley Road, R.D. 2, Doylestown, Pa. 18901

Central Pennsylvania Rock and Mineral Club, Inc.
Meeting: William Penn Memorial Museum, 3rd and North Streets, Harrisburg; 1st Wednesday each month; 7:30 p.m.

Che-Hanna Rock and Mineral Club
Meeting: Sayre High School, Room 113, Sayre; 2nd Wednesday each month.

Chester County Rock Hounds
Mrs. Hoylande White
Westtown School, Box 87, Westtown, Pa. 19395

Delaware Valley Earth Science Society, Inc.
Mrs. Frieda Regensburg, Secretary
123 Spruce Street, Audubon, New Jersey 08106

Eastern Federation of Mineralogical and Lapidary Societies, Inc.
Mrs. Betty Clauser, Editor
593 New Road, Southampton, Pa. 18966

Gem City Rock and Mineral Society, Inc.
Meeting: A. F. Schultz Bldg., 11 East 14th Street, 5th Floor, Erie; 4th Friday each month; 8:00 p.m.

Greater Johnstown Rock and Mineral Club
Meeting: Dale National Bank, Richland; 4th Thursday each month; 7:30 p.m.

Kiski Area Gem and Lapidary Society
Meeting: Community Memorial Bldg., Saltsburg; 3rd Monday each month; 7:30 p.m.

Mineral and Lapidary Society of Pittsburgh, Inc.
Meeting: Richard King Mellon Hall, Duquesne University, Pittsburgh; 3rd Friday each month; 7:30 p.m.

Mineralogical Society of Northeastern Pennsylvania
Meeting: Moosic Presbyterian Church, Scranton; 4th Sunday each month; 2:30 p.m.

Mineralogical Society of Pennsylvania (MSP)
Florence R. Ashbaugh, Secretary
633 Hoffnagle Street, Philadelphia, Pa. 19111

Mittel Appalachia Rock Club
Meeting: Union National Bank Conference Room, Mt. Union; last Tuesday each month; 7:00 p.m.

Monongahela Rockhounds

Meeting: Salvation Army Hall, Homestead; 1st Saturday each month; 7:45 p.m.

Moraine Rockbusters, Inc. Gem and Mineral Society

Meeting: Appalacian Rock Shop, Harmony; 2nd Saturday each month; 7:00 p.m.

Nittany Valley Mineral Club

Meeting: Pennsylvania State University, Room 121, Mineral Industries Bldg., University Park; 3rd Sunday each month; 7:00 p.m.

North Pennsylvania Earth Science

Harry Green

701 West Main Street, Lansdale, Pa. 19446

Pennsylvania Earth Sciences Association, Inc.

Meeting: Keystone Savings & Loan Association Bldg., Bethlehem; last Wednesday each month; 7:30 p.m.

Philadelphia Mineralogical Society

Meeting: Academy of Natural Sciences, 19th & Benjamin Franklin Parkway, Philadelphia; 1st Thursday each month, except January, July, and August; 8:00 p.m.

Rock and Mineral Club of Lower Bucks County, Inc.

Meeting: Fairless Hills Methodist Church, Fairless Hills; 2nd Friday each month; 8:00 p.m.

Schuylkill Valley Earth Science

John Stoler

R.D. 2, Pottstown, Pa. 19464

Susque Rock and Mineral Club

Fred DeWan

667 North Grier Street, Williamsport, Pa. 17701

Tuscarora Lapidary Society, Inc.

Meeting: Delaware County Institute of Science, 11 South Avenue, Media; 2nd Wednesday each month; Sept. to June; 8:00 p.m.

West Penn Micromineral Society

Meeting: Mineral Lab at Carnegie Museum of Natural History, Pittsburgh; 4th Tuesday each month, except December; 7:30 p.m.

York Rock and Mineral Club, Inc.

Meeting: Northeastern High School, Manchester; 4th Tuesday each month; 7:30 p.m.

DEALERS FOR TOPOGRAPHIC MAPS

NOTE: Many of the maps mentioned in this book are stocked and sold over the counter by the dealers listed. They may also be ordered directly from the U.S. Geological Survey, Eastern Region — Map Distribution, 1200 South Eads Street, Arlington, Va. 22202. (Dealers prices may be higher than Survey prices.)

Altoona:
Gwin Engineers, Inc., 1126 8th Avenue.
Bangor:
Bangor Hardware & Paint, 400 South First Street.
Bethlehem:
H. M. Paul & Son, Inc., Office Furniture & Stationery, 529 West Broad Street.
Blakeslee:
The Outdoor Store, Route 115.
Bradford:
W. Michael Roeder, 75 North Center Street.
Brookville:
DeMans, 295 Main Street.
Chambersburg:
Franklin County Planning Commission, Court House Annex.
Clay:
Clay Book Store, Route 322.
Cross Fork:
Cross Fork Tackle Shop, Main Street.
De Young:
Russell City Store, Route 66.
Dover:
74 Sporting Goods, 3753 Carlisle Road.
Doylestown:
Alfred B. Patton, Inc., 31 East Swamp Road.
East Hickory:
Little Store, Route 62.

East Stroudsburg:
Monroe Engineering, Inc., 149 East Broad Street.
Emporium:
Miglicio Enterprises, Inc., Cabin Kitchen.
Erie:
Biking & Hiking, 5158 Peach Street.
Commerical Blue Print & Supply Co., 201 East Tenth Street.
Gettysburg:
Gettysburg Christian Bookstore, 27 Chambersburg Street.
Hanover:
J. W. Fisher & Co., 28 Carlisle Street.
Hawley:
J. Vance Hunt & Son, Editors and Publishers.
Hazleton:
Deemer & Co., 224 West Broad Street.
Honesdale:
M. R. Zimmer & Associates, 939 Main Street.
Huntingdon:
Stephen V. Heine, Inc., 504 Penn Street.
Indiana:
Henry Hall, Inc., Stationers-Printers, 714 Philadelphia Street.
Johnstown:
Turner's Key Shop, 325 Market Street.
Warren Phenicie, 100 Nees Avenue.
Kimberton:
The Village Book Shop, Hare's Hill Road.
Lancaster:
E. C. Herr, Inc., 46-48 West King Street.
Darmstaetter's, Inc., 35-37 North Queen Street.
Lehighton:
Robert P. McCombs Associates, R.D. 1.
Lemoyne:
Camp Hill Distributors, 331 Market Street.
Lewistown:
Aurand's, 229-231 East Third Street.

Lock Haven:
  Fin-Fur Feather Trading Post, Box 59, Star Route 44.
McConnellsburg:
  Robert C. Snyder, Insurance Agency, 105 Lincoln Way East.
Meadville:
  Hunters News, 297 Chestnut Street.
Milford:
  Sportsmen's Rendezvous, 113 West Hartford Street.
Morris:
  Miller's Store.
Paoli:
  Bookmark, 4 East Lancaster Avenue
Philadelphia:
  J. L. Smith Co., 2104 Walnut Street.
Pittsburgh:
  Pen-Oh-Wes Map Co., 511 Magee Bldg., 336 Fourth Avenue.
  J. R. Weldin Company, 413-415 Wood Street.
Reading:
  Earth's Sciences Research Co., 3611 Perkiomen Avenue.
  Moyer's Stationery, Inc., 525 Penn Square.
Saint Marys:
  Smith's Sport Store, 10 Erie Avenue.
Scranton:
  Deemer & Co., 209 North Washington Avenue.
State College:
  The Pathfinder, 202 South Allen Street.
Stroudsburg:
  Stroudsburg Sporting Goods, 13 North Sixth Street.
Ulysses:
  Black Forest Trading Post.
Waterville:
  Love's Service Station
Wellsboro:
  Clark's Sporting Goods Store, 81 Main Street.
  Davis Sporting Goods, 9 Charleston Street.

Whitehall:
 Nestor Sporting Goods, Inc., 2510 MacArthur Road.
Wilkes-Barre:
 Deemer & Co., 6 West Market Street.
Williamsport:
 Nippenose Equipment, 133 West Fourth Street.
 Plankenhorn Stationery Co., 144 West Fourth Street.
 Yoas Service, Inc., 509 West Fourth Street.
York:
 Indian Rock Sporting Goods, Woodbury Road.

ADDITIONAL READING

BOOKS AND PAMPHLETS

American Geological Institute, *Earth for the layman;* this publication lists nearly 1400 popular books on geology and related subjects principally for science teachers, librarians, youth, hobbyists, and those who enjoy geological literature as an avocation; 2101 Constitution Avenue, N. W., Washington, D.C. 20037.

Desautels, P. E. (1968), *The mineral kingdom,* a Ridge Press Book, New York, Madison Square Press, Grosset and Dunlap.

Dietrich, R. V. (1969), *Mineral tables; hand specimen properties of 1500 minerals,* New York, McGraw-Hill Book Company.

English, G. L. and Jensen, D. E. (1959), *Getting acquainted with minerals,* New York, McGraw-Hill Book Company.

Fleischer, Michael (1975), *Glossary of mineral species,* Mineralogical Record Inc., P.O. Box 783, Bowie, Md.

Gordon, S. G. (1922), *The mineralogy of Pennsylvania,* reprinted in 1973 by Friends of Mineralogy, Region 3; order from Bryon Brookmyer, Box 19, Blue Ball, Pa. 17506.

Holden, Alan and Singer, Phyllis (1960), *Crystals and crystal growing*, Science Study Series, New York, Doubleday and Co.

International Mineralogical Association (1974), *World directory of mineral collections*, Miss M. Hooker, Secretary of the IMA, U.S. Geological Survey, National Center 958, Reston, Va. 22092.

Irving, Robert (1956), *Rocks and minerals and the stories they tell*, Knopf and Company.

Jefferis, W. W. (1974), *Mineralogy of Chester County*, Friends of Mineralogy, Region 3, Special Publication No. 2; order from Bryon Brookmyer, Box 19, Blue Ball, Pa. 17506.

Macfall, R. P. (1969), *Gem hunter's guide*, New York, Thomas Y. Cromwell Co.

Montgomery, Arthur (1969), *The mineralogy of Pennsylvania (1922-1965)*, Acad. Nat. Sci. Philadelphia Spec. Pub. 9; sponsored by the Mineralogical Society of Pennsylvania; order from Allen Snyder, 2411 Hillock Court, Lansdale, Pa. 19446.

Palache, Charles, Berman, Harry and Frondel, Clifford (1944), *Dana's system of mineralogy*, New York, John Wiley & Sons, Inc.

Page, P. R. (1975), *Rockhound's directory*, 4th ed., P.O. Box 1233, Gainesville, Fla.

Pearl, R. M. (1955), *How to know the minerals and rocks*, New York, McGraw-Hill Book Company.

——— (1956), *Rocks and minerals*, New York, Barnes and Noble.

Pennsylvania Geological Survey (1975), *Pennsylvania geological publications*, Harrisburg, Pa. 17120.

Pough, F. H. (1955), *Field guide to rocks and minerals*, New York, Houghton Mifflin Co.

Ransom, J. E. (1975), *Gems and minerals of America; a guide to rock collecting*, New York, Harper and Row.

Sanborn, W. B. (1966), *Handbook of crystal and mineral collecting*, Mentone, California, Gembooks.

Shelmella, P. W. (1975), *Dictionary of mineralogical names and associated terminology;* Friends of Mineralogy, Region 3, 32 p.; order from Bryon Brookmyer, Box 19, Blue Ball, Pa. 17506.

Sinkankas, John (1964), *Mineralogy for amateurs,* New York, Van Nostrand Reinhold Co.

__________ (1970), *Prospecting for gemstones and minerals,* New York, Van Nostrand Reinhold Co.

__________ (1972), *Gemstone and mineral data book,* New York, Winchester Press.

Spiroff, Kiril (1959), *Seaman's mineral tables,* Houghton, Michigan, Michigan College of Mining and Technology Press.

Vanders, I. and Kerr, P. F. (1967), *Mineral recognition,* New York, John Wiley & Sons, Inc.

White, A. T. (1955), *All about our changing rocks,* New York, Random House.

Zim, H. S. and Shaffer, P. R. (1957), *Rocks and minerals,* New York, Simon and Schuster, Inc.

MAGAZINES

Lapidary Journal; Lapidary Journal, Inc., P.O. Box 2369, San Diego, California 92112 (monthly).

Mineral Digest – The Journal of Mineralogy; Mineral Digest Ltd., 155 East 34th Street, New York, New York 10016 (quarterly).

Mineralogical Record; The Mineralogical Record, P.O. Box 783, Bowie, Maryland (bi-monthly).

Pennsylvania Geology; Pennsylvania Geological Survey, Department of Environmental Resources, Harrisburg, Pennsylvania 17120 (bi-monthly).

Rocks and Minerals; Rocks and Minerals, 4000 Albemarle Street, N.W., Washington, D.C. 20016 (bi-monthly); official magazine of the Eastern Federation of Mineralogic and Lapidary Societies.

GLOSSARY

Alteration: any change in the mineralogic composition of a rock; applies especially to changes brought about by the entry of hydrothermal solutions into the rock.

Breccia: a rock composed largely of angular fragments of older rocks that have been cemented together. The fragmentation of the older rock is often caused by movement along a fault.

Diabase: a dark-gray igneous rock composed of labradorite laths partly included in pyroxene grains. Diabase forms if the magma cools beneath the earth's surface and tends to be medium grained; whereas basalt, which has the same composition as diabase, forms if the same magma cools on the earth's surface and is usually fine grained.

Efflorescence: a whitish powder forming as a thin incrustation on a rock; formed by crystallization from solution as water evaporates.

Fault: a fracture or break in rock along which vertical or horizontal movement has taken place (compare joint).

Float: rock that is isolated or has moved from the main body of rock from which it originated; for example, a boulder that moved down a hill.

Folia: very thin layers or flakes of minerals; usually applies to mica or chlorite group minerals in schist and gneiss.

Footwall: the underlying side of an inclined fault such that one could, if there were room, walk on it. The overlying side is called the hangingwall.

Gabbro: a dark-colored igneous rock, usually composed of labradorite and augite, which solidified below the surface of the earth.

Gneiss: a metamorphic rock in which bands of light-colored quartz and/or feldspar alternate with bands of dark-colored mica group minerals and/or hornblende.

Hornfels: a fine-grained, tough, metamorphic rock which usually breaks with sharp edges. It is formed from shaly, clay-rich rock which has been baked by a nearby igneous intrusion. Most hornfels rocks in Pennsylvania are gray or dull green and the individual minerals are not usually visible with a hand lens.

Hydration: a chemical reaction whereby water is added to a rock or mineral.

Igneous rock: rock formed from the solidification of magma.

Joint: a fracture or break in rock along which no movement has taken place (compare fault).

Lithification: the conversion of loose, unconsolidated sediment (for example, sand) into solid sedimentary rock (for example, sandstone).

Magma: red-hot molten rock, sometimes containing crystallized grains, which would form igneous rock if given the opportunity to cool.

Meta-: a prefix that, when used with the name of a rock, indicates that rock of that type has undergone metamorphism or change.

Metamict: minerals whose internal crystalline structure has been disrupted by radiation from uranium or thorium. When chipped, these minerals often have a conchoidal fracture and a resinous luster.

Metamorphic rock: rock formed by the conversion of older igneous, sedimentary, or metamorphic rock in response to a change in temperature and/or pressure.

Pegmatite: an igneous rock composed of large mineral grains (often more than 1 inch across), usually occurring in veins or large tabular bodies. Pegmatites have cooled slowly beneath the surface of the earth. Most pegmatites have the composition of a granite but a few are also enriched in rare minerals such as beryl, columbite, and spodumene.

Phenocryst: a relatively large crystal in an otherwise finer-grained igneous rock.

Pisolite: a sedimentary rock composed of small, pea-like structures that are cemented together.

Polytypes: different forms of a certain few minerals that occur because of difference in the order in which the layers of atoms are stacked.

Precipitate: a mineral that crystallized from a hydrous solution because of a chemical reaction.

Sedimentary rock: rock formed from the consolidation of loose sediment by cementation or recrystallization; also, rock that formed by precipitation from solutions at surface conditions, such as in shallow water.

Scalenohedron: a crystal with faces in the shape of scalene triangles.

Schist: a foliated metamorphic rock containing predominantly hornblende and mica group minerals which are oriented parallel to each other.

Skarn (tactite): a metamorphic carbonate rock, formed from rocks such as limestone, which has been baked by and had certain elements added from a nearby igneous intrusion. The resulting marble-like skarn often contains garnets, pyroxenes, and amphiboles.

Unconformity: a substantial interruption in the deposition of sedimentary rock, caused by a period of nondeposition, possibly accompanied by erosion of some layers previously deposited.

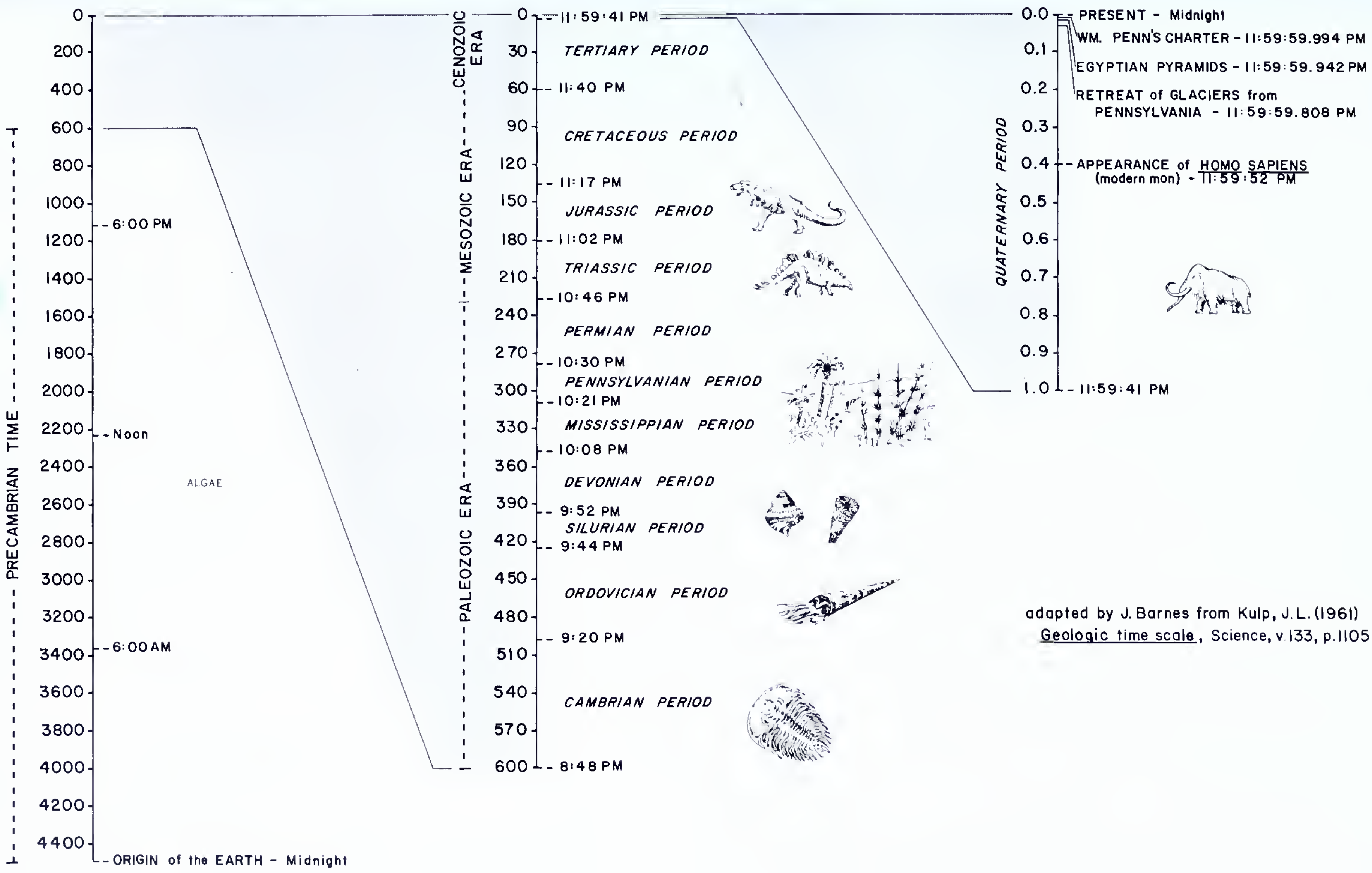
Vesicle: a small hole in an igneous rock, such as lava, where a gas bubble was trapped by solidifying magma.

Zeolite: a type of silicate mineral which contains mobile water and elements such as sodium, calcium, or potassium. They are usually formed by hydrothermal alteration of a basalt, diabase, or hornfels. Unlike true mineral groups, they have many different structures, and, hence, their habits vary considerably.

MINERAL INDEX

LOCALITY INDEX

GEOLOGIC TIME SCALE (IN MILLIONS OF YEARS) COMPARED TO A TWENTY-FOUR HOUR DAY



adapted by J. Barnes from Kulp, J.L. (1961) Geologic time scale, Science, v.133, p.1105-1114.